ENHANCING THE RESIDENT RESEARCH TRAINING CLIMATE IN ANESTHESIOLOGY THROUGH ACTION RESEARCH

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ABSTRACT

The purpose of this action research study was to understand the research training climate in anesthesiology at the University of Saskatchewan, and to collaboratively determine strategies for addressing persistent challenges to resident research training. Whilst there have been a number of published research training programs, influence over priorities has been top-down. Medical educators have lacked a model for collaboratively enhancing the research climate for trainees in anesthesiology.

A three-phase, sequential mixed methods design was employed. In phase one, residents completed the revised Research Training Environment Scale as a quantitative measure of the research climate. In phase two, ten residents and six faculty mentors participated in semi-structured interviews to explore the underlying reasons for lower-scored items, and to generate suggestions for improvements to guide three simultaneous action research cycles. An advisory group collaboratively decided upon three actions for improvement of the research training climate. Phase three followed the initiation of three simultaneous action research cycles to reflexively evaluate the impact of these actions.

The use of action research to identify shortcomings, generate solutions, and collaboratively choose actions for improving the research training program inspired changes to the research climate including: 1) the addition of research presentations by senior residents and faculty mentors at the research orientation for first-year residents to enhance communication of ongoing and new research ideas, and provide earlier exposure to faculty, 2) the creation of an online repository of research resources for enhanced communication of research ideas and to offer examples of past study-related documents, and 3) the encouragement of resident collaboration by offering a range of options such as involvement in individual projects, new team

projects, and ongoing projects. Furthermore, during the course of this research, residents and faculty engaged in reflection-on-action and highlighted several additional suggestions for future action research cycles.

This research offers two main contributions to theory. First, this study produced a model whereby action research could be used by others in pre-existing resident research training programs. Second, this study further conceptualized research culture in one postgraduate medical education, specifically by elucidating some of the underlying assumptions that formed the essence of the culture.

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Table of Contents

List of Tables

List of Figures

CHAPTER 1

THE PROBLEM

The Royal College of Physicians and Surgeons of Canada (RCPSC, 2005) requires that all medical specialty training programs, including those in anesthesiology, facilitate scholarly activity during residency education. In the *Draft CanMEDS 2015 Physician Competency Framework*, the role of "Scholar" has set forth the expectation that "physicians demonstrate a lifelong commitment to excellence in practice through continuous learning, the teaching of others, the evaluation of evidence, and contributions to scholarship" (Richardson, Oswald, Chan, Lang, & Harvey, 2014). However, the method whereby this is achieved varies greatly across training programs.

Research Training Programs

There are several models that exist for scholarly training during residency. Postgraduate medical training often includes a research component to develop physician-scientists who will investigate clinical problems and bridge the knowledge-to-practice gap. Investigations into resident research training have demonstrated increased knowledge and skills of trainees (Lowe et al., 2007; Oxnard, Zinkus, Bazari, & Wolf, 2009; Rydman, Zalenski, & Fagan, 1994), but this has been conditional on the research training being done well (Aslam, Qayyum, Mahmud, Qasim, & Haque, 2004; Butt & Khan, 2008; Cronk, Hetz, & Azarow, 2005; Kenton & Brubaker, 2007). Resistance from residents and faculty, and lack of time, experienced mentors and support staff have been cited as the main barriers to resident research (Hebert, Smith, Levine, & Wright, 2003; Seehusen & Weaver, 2009). In addition, discrepancies between resident and faculty perceptions of these challenges have been identified (Buschbacher & Braddom, 1995; Silcox, Ashbury, VanDenKerkhof, & Milne, 2006).

Studies of resident research training have tended to approach the issue in one of three ways. First, those oriented in a post-positivist tradition have demonstrated the factors of resident research training that contribute to productivity (Karras et al., 2006). Second, those more oriented in constructivist theory have investigated resident, faculty, and clinician perceptions of resident research training (Buschbacher & Braddom, 1995; Spice, Palacios, Biondo, & Hagen, 2011). Finally, those with a pragmatic orientation have approached resident research training using improvement models (Kanna et al. 2006) or evaluation and modification (Spice et al., 2011). Rothberg, Kleppel, Friderici, and Hinchey (2014) implemented a resident research program in a stepwise fashion, specifically designed to overcome barriers to resident research that had been identified in the literature and through program participants' experiences, while Tulinius et al. (2012) strove to increase the academic capacity in family medicine through collaborative development of a training program. However, collaborative improvement of a relatively developed resident research program has not been described. This study was guided by the belief that collaborative engagement by resident trainees and faculty mentors might result in improvement of the research program, and enhancement of the residency program's research climate and scholarly culture. The roles of organizational climate and culture in resident research programs have not been well described.

History and Context of Research Training in Anesthesiology

The local resident research program in anesthesiology at the University of Saskatchewan was designed to span the first 4 years of a 5-year residency. The research program began with an orientation to the research requirement in the summer, where residents were encouraged to start talking with faculty members about research ideas. Effective in the fall term of 2008, the first-year residents were required to complete a 16-week online graduate course in clinical research

methodologies. The research methods course was designed to help residents search the literature, prepare a synthesis of the literature and refine their research question, and culminated in a research proposal as their final assignment. In their second year, residents were expected to make applications to the research ethics board and the health region for approvals to conduct the study, and present their proposal at a departmental journal club for peer review. Third and fourth years were dedicated to data collection and analysis. Subsequently, residents were required to disseminate their results.

Presentation opportunities were encouraged throughout the program, starting with the preparation of a poster as part of the clinical research methodologies coursework and culminating with presentations at local resident research competitions in anesthesiology, the College of Medicine, and the Annual Life & Health Sciences Research Day. Residents conducting research projects with widely applicable findings were encouraged to present at the Canadian Anesthesiologists' Society annual meeting, or another appropriate national or international conference. Residents having projects with a quality improvement focus were encouraged to present at a health region conference focused on quality. Residents were also pressed to submit a manuscript or Letter to the Editor to report their findings.

Initially, residents were unenthusiastic about meeting these additional requirements and deadlines. However, as the research program became ingrained into residency requirements and an increased proportion of residents participated, the research requirement gradually gained acceptance. In the past few years, our residents have celebrated successes such as presentations at national and local conferences, publications in peer reviewed journals, and some moderate grant funding. We were headed in the right direction, but with some fine-tuning, could potentially expand on these successes. Despite the structured resident research program in

anesthesiology, we continued to experience challenges including – but not limited to – a lack of experienced mentors, funding, time, and research assistants, as well as delayed timelines, and dead-end projects.

Researcher Positioning

In 2007, the Department of Anesthesiology at the University of Saskatchewan introduced a structured Resident Research Program and contracted me as a research coordinator to supervise and assist in all phases of the resident research training under the supervision of the Research Director. As the Research Coordinator responsible for overseeing all phases of the resident research program, I was acutely involved in each step of each resident project and was interested in finding solutions to strengthen the research training climate and resident research culture.

Action research is a research methodology whereby small changes may be brought about through cycles of observing current practices, planning changes, acting upon these plans, and reflecting on their impact. Action research has been characterized by its emergent design, reflective practice, practical application, and researcher positioning as a practitioner in the setting to be studied. This approach offered some promise for addressing the persistent challenges of resident research training that I had been experiencing in my professional work as the Research Coordinator in the Department of Anesthesiology because it legitimized the pursuit of recommendations from the residents and faculty mentors that were subjected to the research requirements, while drawing upon research evidence for guidance. To establish process validity in this study, I intended to frame the problem in a way that promoted ongoing learning and to triangulate findings with resident and faculty perspectives (Anderson & Herr, 1999).

In action research, the researcher is an active participant in problem solving (Greenwood & Levin, 2007), because she is oriented as an insider within a particular practice setting (Herr &

Anderson, 2005). Altheide and Johnson (2011) declared that a "key part of the ethnographic ethic is how we account for ourselves" (p. 519) through reflexive accounting of problems and experience in the research. In addition, Schein (2010) asserted that the researcher's role in exposing organizational culture is to get at the shared basic assumptions and to understand how these assumptions evolve. Therefore, I attempted to exemplify these principles in the current study.

Statement of the Problem/Purpose of the Study

Whilst there have been a number of published research training programs, influence over the priorities has tended to be top-down. Medical educators have lacked a model for collaboratively enhancing the scholarly environment for trainees in anesthesiology.

The purpose of this action research study was to understand the research training climate in anesthesiology at the University of Saskatchewan, and to collaboratively determine strategies for addressing persistent challenges to resident research training. A three-phase, sequential mixed methods design was employed to: 1) identify shortcomings in the research training climate, 2) explore resident and faculty perceptions of the underlying reasons for these shortcomings, and 3) explore the impact of the co-generated solutions initiated as three sequential action research cycles. For the purposes of this study, the research training climate was defined as resident and faculty perceptions of the research training environment. I have previously described this research training climate as a tangible artifact of the research culture in postgraduate medical education (O'Brien, 2013).

The Research Questions

This study was designed to answer the following research questions:

1) What shortcomings in the research training climate will be identified by residents and faculty in anesthesiology at the University of Saskatchewan? (Quan)
2) When afforded the opportunity to collaborate in improvement of the resident research program, what three interventions will be proposed by residents and faculty to achieve the ideal resident research training environment? (Qual)
3) What can action research, as a dialectical process of co-generating solutions to practical challenges, offer to our understanding of research training in residency?
4) What we can learn about the research culture of this post-graduate training program in anesthesiology?

Description of the Study

This action research study was approached within a pragmatic paradigm (Greenwood & Levin, 2007; Tashakkori & Teddlie, 2003), using both qualitative and quantitative data. A three-stage sequential mixed methods design was applied to three simultaneous action research cycles.

In the quantitative phase, the entire population of 36 residents across five years of postgraduate training were invited to complete the revised Research Training Environment Scale (R-RTES) (Gelso, Mallickrodt, & Judge, 1996) as part of a program evaluation of the research training program in anesthesiology. The R-RTES measured the research training environment in anesthesiology on nine subscales: 1) faculty modeling of appropriate scientific behavior, 2) positive reinforcement of scholarly activities, 3) early, minimally threatening research involvement, 4) teaching relevant statistics and the logic of design, 5) teaching students to look inward for research ideas, 6) science as a partly social experience, 7) emphasizing that all studies are flawed and limited, 8) focus on varied investigative styles, and 9) wedding of science and

clinical practice. Quantitative data from the R-RTES was analyzed by summing the six items within each subscale and by calculating mean scores to identify areas of perceived shortcomings.

The qualitative phase followed analysis of the R-RTES results. A conveniently-selected subsample of at least two residents from each postgraduate year of training (2x5=10 residents) and at least four faculty research mentors in anesthesiology was selected by the researcher who was also the Research Coordinator in anesthesiology. Residents and faculty mentors were invited to engage in semi-structured interviews and focus groups of 2-5 participants, to explore the underlying reasons for identified shortcomings, and to generate ideas for solutions to guide three simultaneous action research cycles. Qualitative data from recorded interviews and focus groups were analyzed according to the reflexive and iterative process described by Halcomb and Davidson (2006). This process involved: 1) audiotaping of interview and concurrent note taking, 2) reflective journaling immediately post-interview, 3) listening to the audiotape and amending/revising field notes and observations, 4) preliminary content analysis, 5) secondary content analysis, and 6) thematic review. An advisory committee of attendees at a Departmental Journal Club reviewed findings from interviews and focus groups, and collaboratively decided upon actions for improvement.

The third phase followed the initiation of three collectively chosen action research cycles to reflexively evaluate the impact of these actions following their implementation.

A theory of organizational culture (Schein, 2010, 2000) guided interpretation of the data. Schein (2000) described an organization's climate as a product of the organizational culture. Climate, the way in which members perceive the organizational environment, represents artifacts of the culture.

Significance

It was important to study the collaborative improvement of resident research training because there have been a few key concerns that were consistently raised in the literature pertaining to resident research, but no published accounts of recognizing local challenges in a relatively developed training program and collaboratively generating solutions among residents and faculty mentors. Action research and organizational learning theories have both advocated collaboration and democratic principles in the co-production of knowledge. As such, the focus of each action research cycle was determined through consultation with residents and faculty mentors. Given the multitude of models for training physicians in research, I believed that exploring the application of action research in a single residency program would offer more to other training programs than a prescriptive solution.

Medical educators lacked a model for overcoming persistent challenges to resident research. This study was the first attempt to apply action research and the principles of organizational learning to the persistent challenges in a relatively developed resident research training program. It took a local, collaborative approach to generate priorities for improvement based on first-hand experiences of residents and faculty with the local research training program. By discursively reflecting on the shortcomings of the research training climate as perceived by residents and faculty mentors in a local residency program, and by acting upon collaboratively-generated solutions to a practical problem, this study produced a net benefit to trainees and faculty by responding to the needs, values, and priorities of this specific practice setting. Furthermore, this study produced a model to demonstrate the feasibility of using action research to improve resident research training for other local, national, and international programs.

Delimitations of the Study

The following parameters were applied to the current study:

Theoretical Approach

While I draw upon Schein's (2010) theory of organizational learning within a larger theory of organizational culture to orient the current study within a pragmatic, collaborative, and democratic tradition of solving problems through the co-generation of knowledge, I recognize that this is a vast area of scholarship that I did not choose as the conceptual framework for this study.

Study Site

This study took place in a single residency training program in the Department of Anesthesiology, Perioperative Medicine, and Pain Management at the University of Saskatchewan. This was justified because of what Senge (1994) has described as *localness* of the problem and possible solutions to enhance the research training program.

Timeline

Data collection began in December 2013, and continued until August 2014 when three simultaneous action research cycles had been initiated and participants had the opportunity to evaluate their impact through reflection and discourse. The timeline was initially dependent upon the actions that were chosen by participants to guide the study. At the outset, the R-RTES assessed the shortcomings of the research training climate in December 2013. Semi-structured interviews were conducted between February and March 2014, where participants engaged in reflection and dialogue based on the results of the climate assessment to identify three challenges for targeted intervention. Findings from both quantitative and qualitative phases of the study were reviewed by residents and faculty at a departmental journal club in April, 2014, and three

actions were chosen to improve the research training climate. Upon implementation of the study actions from June to July 2014, participants again engaged in semi-structured interviews in July and August 2014 to reflect and dialogue about the effect of this participatory approach to improvement to the research training program.

Limitations of the Study

Several parameters that were beyond the control of the researcher impacted the success of this study, including the extent to which individual participants were willing to share their reflections in small groups. Additionally, this included the extent to which the Program Director and Research Directors who controlled the resources were willing to adopt Lewin's (1948) pluralistic and democratic principles of action research by sharing control of decision-making and resource allocation.

While I encouraged open and honest reflexive discourse among participants, I could not control for any reluctance or over-enthusiasm to voice perceptions that were directed toward any particular person or position (e.g. me as the Research Coordinator, the Program Director, the Research Director(s), or a faculty member known to be the resident's mentor). It was my hope that the collaborative approach to reflection and public dialogue would reveal any discrepancies between espoused theories and theories-in-use (Argyris, 1993).

The decision on actions to improve the research training program were limited by the short timeframe of the current study, and the feasibility of implementing structural changes that required additional resources of time or money. However, suggestions which required longer timelines for implementation were noted, and may be pursued in the future. A common complaint from previous research was the lack of time and funding, and conflicts with clinical commitments (Hebert et al., 2003); these reflected leadership priorities that were beyond the

control of the researcher in the current study. However, it was hoped that the action-oriented approach to improvement would assist in collaboratively setting priorities to overcome any recognized challenges to resident research training.

Definitions Used in the Study

To maintain a focused research proposal and to facilitate a common understanding of terminology, I have set out the following definitions of key terms used in this proposal.

Resident Research Curriculum

This refers to a formalized program of research training required by residency training programs, and is used interchangeably with Research Training Curriculum.

Resident Research Program

This refers specifically to the local resident research curriculum in the Department of Anesthesiology, University of Saskatchewan.

Residency Training Program/Residency Program

After completion of medical school, trainees enter a postgraduate medical education specialty program, such as anesthesiology, general surgery, pediatrics, etc.

Collaborative Action Research

As a research design, collaborative action research involves teamwork among stakeholders to facilitate educational improvement. In this study, collaboration on decisions that guide the study actions occurred among anesthesia residents, faculty mentors, and the researcher.

Research Culture

I have defined the research culture in postgraduate medical education previously as "the extent to which research activity has been integrated into the shared vision and values, and communicated within the residency program" (O'Brien, 2013). I went on to contend that

research culture can be recognized through the shared language, symbols and artifacts, beliefs, assumptions, and practices of the residency program.

Research Climate

The research climate is defined herein as resident and faculty perceptions of the research training environment, and a tangible artifact of the research culture.

Reflexive Discourse

Reflexivity in practice is a concept that has been expounded by Schön (1984), and elaborated by Mazutis and Slawinski (2008). Reflexive discourse is a strategy whereby the researcher can uncover underlying assumptions of a group through public discussion of participants' personal reflections, thereby facilitating group learning. This definition is grounded in Schön's (1984) theory of Reflection-in-Action as a process whereby professionals reflect upon tacit assumptions to reconcile action and understanding, and Senge's (1994) assertion that group learning begins with dialogue.

Organization of the Dissertation

The objective of this dissertation was to explore collaborative enhancement of the research training climate in anesthesiology while theorizing about research culture in postgraduate medical education. In this chapter, I have outlined the general approach to the study.

In the second chapter, I offer a framework for thinking about enhancing the research culture in resident training. I use Schein's (2000, 2010) theory of organizational culture to illustrate the inadequacy of current approaches to studying resident research success. First, I discuss the relationship between organizational climate and culture. Next, I review the current state of knowledge pertaining to successful research training in residency. Finally, I argue that

previous work has focused both on integrating artifacts of a research culture and on emphasizing the espoused beliefs of leaders, while neglecting the underlying shared assumptions that are a product of the research culture in postgraduate medical education.

In the third chapter, I offer a theoretical and historical overview of action research and relate this to Schein's (2010) theory of organizational learning to orient the current study within a pragmatic, collaborative, and democratic tradition of solving problems through the co-generation of knowledge. I further describe a three-phase action research study using a sequential mixed methods design to quantify the research climate in a single anesthesia residency program as a basis for collaborative dialogue into the root of the problems and actions for improvement.

The results chapters are laid out temporally. In Chapter 4, I describe the results of the program evaluation phase, where residents were asked to complete a quantitative measure of the research training environment, the R-RTES (Gelso et al., 1996). In Chapter 5, I summarize findings from the semi-structured interviews, conducted to explore the underlying reasons for identified shortcomings, and to generate ideas for solutions to guide three simultaneous action research cycles. I end this chapter with a description of the priorities for action that were collaboratively set by residents and faculty. In Chapter 6, I describe the implementation of actions for improvement and present the results of the follow-up semi-structured interviews that were conducted to investigate resident and faculty perceptions of the impact of these actions.

In the final chapter, I review the background rationale that inspired this study and briefly describe the methodological approach before highlighting the main findings. Throughout Chapter 7, I position the main findings within the existing literature. Most notably, I offer a model for using action research to improve resident research training before returning to the

conceptualization of research culture presented in Chapter 2 to refine it based on findings from the current study. Finally, I highlight the main contributions to theory and practice, and offer directions for future research.

CHAPTER 2

LITERATURE REVIEW

This literature review is grounded in educational climate studies which theorize that educational climate strongly affects student success, achievement, and satisfaction (Cavanaugh & Simmons, 1997; Pimparyon, Roff, McAleer, Poonchai, & Pemba, 2000; Till, 2005) and in theories of organizational culture as described by Schein (2000, 2010). Furthermore, it is grounded in a belief that collaborative engagement by residents and faculty would result in improvement of the research training environment in anesthesiology. The framework for thinking about the enhancement of research culture in residency unfolds in the following manner. First, I discuss the relationship between organizational climate and culture. Next, I review the current state of knowledge pertaining to successful research training in residency. I argue that previous work has focused both on integrating artifacts of a research culture and on emphasizing the espoused beliefs of leaders, while neglecting the underlying shared assumptions that are a product of the research culture in postgraduate medical education. Finally, I describe a conceptual framework for thinking about the research culture in resident training.

How We Perceive our Scholarly Environment: Organizational Climate & Organizational Culture

Climate and culture are two ways of understanding participants' experience in organizations (Schneider, 2000), although the relationship between these two constructs has a long history. The Handbook of Organizational Culture & Climate (Ashkanasy, Wilderon, & Peterson, 2000) opened with two commentaries. In the first, Benjamin Schneider recognized the divide that had existed between climate scholars and culture scholars, and argued that culture and climate are usefully, conceptually, and practically linked. Furthermore, Schneider (2000)

suggested that scholars ought to find common ground to investigate the relationship between them. In the second commentary, Edgar Schein (2000) argued that climate is a cultural artifact. Below, the relationship between climate and culture is discussed to establish a foundation for looking at the scholarly culture manifest in resident research training.

Climate research can be considered an elder sibling to the more recent emphasis on culture in organizations. Ashkanasy et al. (2000) attributed the origins of climate research to the convergence of field theory, which emphasized the importance of context, and the quantitative study of attitudes within organizations using Likert scales. In medical schools, climate has been equated to the educational environment (Genn & Harden, 1986), which initiated a surge of studies investigating student perceptions of the educational environment (Bassaw et al, 2007; Mayya & Roff, 2004; Roff & McAleer, 2001; Till, 2004; Till, 2005). The educational climate of a school affects student learning, achievement, and satisfaction (Lonka et al., 2008; Till, 2005).

Culture research emerged from the alienation of some scholars from climate research because of the emphasis on quantitative measurements (Ashkanasy et al., 2000). They claimed that climate research was a field dominated by scholars of psychology and sociology, so dissenting scholars turned to cultural anthropology as a way to better represent the context of individuals' attitudes and perceptions in the context of organizations (Ashkanasy et al., 2000). They further stated "the study of organizational culture has brought ways of thinking holistically about systems of meaning, values, and actions from anthropology into organizational studies" (Ashkanasy et al., 2000, p. 5).

Three levels of culture have been presented to describe the degree to which manifested cultural phenomena are observable: artifacts, espoused beliefs, and deeper assumptions (Schein (2010). Artifacts are the visible products of a culture such as policies, the built environment, the

language and behaviours of members, myths, stories, rituals, ceremonies, and climate. Espoused beliefs describe those things which organizational members claim to value and believe. The perceptible products of a culture are those which correspond most closely to the constructs that climate scholars have traditionally measured. Schein's (2000, 2010) theory of organizational culture extends climate scholarship by exposing the leader's beliefs and values which, when empirically tested, result in shared assumptions among group members.

Organizational cultures have been further theorized to exist within various contexts. To fully understand cultural forces within organizations, Schein (2010) argued for the necessity of understanding both the *macroculture* within which it exists, the interactions among *subcultures*, and the *microcultures* that develop in small groups that share common histories. This perspective adds a more nuanced approach to examine climate as a product of various groups' beliefs and assumptions within an organization, such that students and teachers – or residents and faculty mentors – may share some common cultural beliefs and assumptions while diverging on others.

Student perceptions of the learning environment, also known as the climate, are manifestations of the scholarly culture of a learning environment. Schein defined climate as "a cultural artifact resulting from espoused values and shared tacit assumptions" (2000, p. xxiv), and as "[t]he feeling that is conveyed in a group by the physical layout and the way in which members of the organization interact with each other, with customers, or with other outsiders" (2010, p. 15). Thus, to study culture, it may be useful to expose these cultural artifacts to facilitate the recognition of espoused values and tacit cultural assumptions. The educational climate that is desired by residents and faculty must be congruent with the underlying cultural assumptions in order for change to occur (Schein, 2000). In other words, student perceptions of

the existing learning environment and what they espouse as their ideal learning environment are rooted in the underlying cultural assumptions that are shared among organizational members.

Returning to the topic of resident research training, one can conclude that the factors associated with successful programs, such as the presence of a research director, faculty mentors, protected time, and so on, are artifacts of the research culture in various residency programs. Furthermore, the level of program directors' and research directors' espoused support for research is a product of the culture as well. However, a discussion of research culture in residency must comprise a more complete picture of cultural artifacts, espoused beliefs and values, and those underlying assumptions systems in any given culture. This research was based on the belief that there is more to creating a successful resident research culture than the establishment of artifacts which mimic successful cultures.

The perceived climate is an artifact of the organizational culture (Schein, 2000). Through discussion, espoused beliefs can be revealed and deeper assumptions may be revealed. Schein (2000) stated: "An ideal research design would measure the present and desired norms, and then check in the underlying assumption set (through group interviews that get at assumptions) why discrepancies exist between the present state and the desired state in the first place. It is the causes of discrepancies that [leaders] need to understand in order to determine what kind of culture change program to launch to achieve greater [program] effectiveness" (p. xxviii).

Schein's (2000) theory of organizational culture is useful to a study of resident research training because it provides various constructs to consider when examining the research culture in postgraduate medical education. Schein (2000) claimed that "[c]limate can be changed only to the degree that the desired climate is congruent with the underlying assumptions" (p. xxix). He argued that surveys of climate are insufficient for generating change; one must examine the

underlying assumptions of the culture which manifest through members' perceptions of climate. Schein's argument provides the rationale for the current study design. By capturing cultural artifacts and members' espoused beliefs, attitudes, and perceptions through an assessment of climate, the foundation will be laid to expose the assumptions which underlie the existing climate.

A Cultural Perspective on Successful Resident Research Training

In adopting a cultural perspective on the enhancement of resident research training, it is necessary to consider issues of external adaptation. External adaptation has been defined as those critical external issues that groups face, which lead to problem-solving and the development of shared cultural assumptions based on the outcome of interventions (Schein, 2010). The wider context of research in postgraduate medical education represents societal demand for well-trained physicians, as well as pressures from accreditation agencies and medical schools to increase scholarly productivity. Below, the external forces which drive research culture in residency are discussed to provide the foundation for a presentation of the successful responses from residency programs.

Why is resident research training important?

It is important to develop research skills in trainees for several reasons, including the need for physicians who can interpret the medical literature in practice, and the need to encourage physician-researchers who can solve problems of practice and advance knowledge in the field. In his seminal work *The Vanishing Physician-Scientist?*, Dr. Andrew Schafer (2009) argued that "physicians have played a vital role in advancing medical knowledge throughout history, and that their participation in the medical research enterprise in the future will be if anything more vital" (p. iv). Program directors in obstetric and gynecology programs in Canada

and the United States rated the ability to interpret medical literature as the most important scholarly skill for residents (Kenton & Brubaker, 2007). This skill facilitates evidence-based patient care and critical appraisal of the medical literature. It also contributes to the recognition of important clinical questions requiring scholarly investigation and experimentation.

Clinician-Scientists. Although advances in health research have led to innovations in prevention, diagnosis, and treatment, there are dual implementation gaps between biomedical discoveries, clinical practice, and patient outcomes. The Canadian Institutes of Health Research (CIHR), among others, have attributed this problem to a lack of clinical researchers who can bridge science from bench-to-bedside (CIHR, 2011, Schafer, 2009). Furthermore, these funders are anxious to see payoffs in patient outcomes, as health problems persist.

More specifically, there is a lack of anesthesiology physician scientists in U.S. academic medicine (Schwinn & Balser, 2006). In comparing the percentage of anesthesiology research to be successfully funded by the National Institutes of Health (NIH) relative to peer academic specialties, Schwinn and Balser (2006) highlighted a deficiency in the level of funding to anesthesiology departments since 1975. Since anesthesiology comprises about 6% of the total medical workforce, the authors claimed that anesthesiology was severely underrepresented in NIH-funded investigators, as it only obtained about 1% of the total NIH funding each year. In addition, clinician-scientists who hold successful NIH grants are relatively mature, with very few junior clinician-scientists willing to follow in their shoes. In one survey of Canadian anesthesiology residents, those with a graduate degree reported they would be more likely to pursue an academic career than did those without this credential (52% vs. 24%) (Silcox et al., 2006). Schwinn and Balser (2006), along with an accompanying editorial (Warner & Hall,

2006), concluded that research training must be drastically increased to encourage anesthesiology trainees to pursue research careers.

Research training has been repeatedly endorsed as the solution to issues of external adaptation, to increase clinician-scientists and to forward the evidence-base of medicine (Armstrong, DeCherney, Leppert, Rebar & Maddox, 2009; Lander, Hanley, Atkinson-Grosjean, 2010; Schafer, 2009). However, its success has been limited. Among 61 survey respondents in geriatric medicine, many trainees were interested in doing research, but did not know how to plan, fund and execute a research project; 70% of respondents indicated difficulty establishing a topic to research, and 64% did not know how to develop an idea (Myint, MacLullich, & Witham, 2006). Furthermore, a survey of orthopaedic graduates suggested that an elective research year during residency did not make them more likely to enter into an academic career (Segal, Black, Schwentker, & Pellegrini, 2006). The production of clinician-scientists likely involves other factors besides straightforward resident research training.

Accreditation requirements. In response to the above-noted concerns, accreditation bodies charged residency programs with educating trainees to contribute to the creation, dissemination, and judicious application of new knowledge (Accreditation Council for Graduate Medical Education, 2011; Royal College of Physicians and Surgeons of Canada, 2005). The Royal College of Physicians and Surgeons of Canada (RCPSC, 2005) required that all medical specialty training programs, including those in anesthesiology, facilitate scholarly activity during residency education. Previously, within the Royal College's framework of physician competencies called the "CanMEDS roles," the role of "Scholar" set forth the expectation that residents contribute to the development, dissemination, and application of new knowledge and practices. However, the responses from residency programs to this demand for external

adaptation varied greatly, despite recent moves toward increased training in research methods and critical appraisal of the medical literature in specialty training programs across Canada. In the Draft CanMEDS 2015 Physician Competency Framework, the role of "Scholar" has set forth the expectation that "physicians demonstrate a lifelong commitment to excellence in practice through continuous learning, the teaching of others, the evaluation of evidence, and contributions to scholarship" (Richardson et al., 2014). The RCPSC is currently holding consultations to update the competency-based framework to include milestones within each role of the existing framework, including the Scholar role. The milestones will provide clear targets for learning and will help educators mark the progression from basic competence to advanced practice within each role. However, the current requirements are wide open to interpretation, and residency programs were left to develop individual implementation plans to meet the learning objectives within their local contexts. In an attempt to assess the scholarly environment, research activity, and support for research in anesthesiology training programs, Nasr, Ahmed, Bonney, and Schumann (2012) conducted a nation-wide survey of program directors and residents in Clinical Anesthesia (CA) years 1-3 of U.S. anesthesiology training programs. The authors found that mentorship and adequate funding for resident research were available in the surveyed sample, but the demands of residency and the early stage of training of most respondents were obstacles to research. Unfortunately, the authors did not report whether the survey was piloted to increase internal validity, and the response rate was very low (31.3% for program directors and 4% for residents). The low response rates (extremely low for residents) suggests that caution must be exercised when interpreting these results; the results cannot be generalized to all anesthesiology residency programs in the U.S.

Prevalence of Research Training

Most Canadian anesthesiology residents are involved in research projects during residency (Silcox et al., 2006). A profile of U.S. anesthesiology resident programs suggested that there were three general domains of research education: those that offered didactics for all residents in the program (with or without an experiential component), those with dedicated research pathways for a self-selected subset of residents wishing to gain additional research experience, and those that extended or overlap research experience during residency with a fellowship (Nagle, 2011). Nagle (2011) suggested that the majority of electronically published research training programs in anesthesiology were less than 10 years old and only targeted a self-selected subgroup of all residents in anesthesiology. However, this profile, generated through an online search of all ACGME programs in the United States, was limited by the small sample of programs that have published the research component of their residency programs online. National surveys of anesthesiology training programs suggested that the most common domain of research education was the first option: didactics for all residents in the program (Ahmad, De Oliveira Jr., & McCarthy, 2013; Nasr et al., 2012; Silcox et al., 2006)

Artifacts of Successful Resident Research Training

The importance of environmental characteristics of the institution, in addition to individual characteristics and effective leadership, have been demonstrated to contribute to highly productive research departments (Bland, Center, Finstad, Risbey, & Staples, 2005; Weber-Main, Finstad, Center, & Bland, 2013). These observable products of the research culture in residency are discussed below.

Resident research activity increased after the institution of a resident research requirement (Fischer & Cation, 2005; Kurahara et al., 2012; Seehusen & Weaver, 2009).

Furthermore, completing and publishing a research project during training were characteristics almost unanimously associated with relatively developed research programs (DeHaven, Wilson, & O'Connor-Kettlestrings, 1998). However, successful resident research training involves many more factors. In a review of the literature pertaining to teaching research in Family Medicine, Seehusen and Weaver (2009) found factors consistently associated with successful research outcomes to include faculty mentorship, a structured curriculum, a forum for resident research presentations, technical support for statistical, administrative, and editorial assistance, protected research time, and funding support.

Creating a culture of inquiry has been suggested to enhance the positive research culture in Family Medicine (Seehusen & Weaver, 2009). One study showed that in research-oriented programs, residents are more likely to receive formal training in research, have more positive attitudes towards research, and be more productive (DeHaven et al., 1998). Other factors associated with a successful resident research program have been cited as the presence of a research director, a research elective, a research requirement, and availability of funding (Fischer & Cation, 2005).

The impact of individual interventions to increase resident research activity can be difficult to separate (Fischer & Cation, 2005). In one description of a 4-stage implementation strategy to increase resident research activity in an internal medicine residency program, increased activity was defined as submission of a project to a competitive forum (Fisher & Cation, 2005). Prior to implementation of these interventions, there was no research curriculum, structured mentorship program, or formal monetary support for resident research. After the conduct of an informal needs assessment, four strategies were devised to increase research activity, including: 1) the appointment of a research director, 2) a 1-month elective research

rotation, 3) financial reimbursement for project expenses, and finally, 4) a requirement for resident research. Authors noticed the greatest increase in research activity of trainees after interventions which saw the institution of a resident research requirement and cost reimbursement. Although they recognized that they could not separate the impact of each intervention, the overriding goal of increasing resident research activity over a short period of time (January 2000 – July 2001) through the combination of four interventions was achieved. The authors also noted a marked increase in faculty research activity as an unanticipated benefit.

Research director. The effectiveness of a research director to facilitate research activity has been investigated with conflicting results. A research director has been recognized as an important factor by Durning et al. (2004) in Internal Medicine, and Blanda, Gerson, and Dunn (1999) in Emergency Medicine. It was also one of the four initiatives implemented by Fischer & Cation (2005) to successfully increase resident research activity. However, Karras et al. (2006) were not able to demonstrate higher levels of publications, number of grant awards, or amount of grant funding in emergency medicine programs boasting a research director. However, despite the ease of calculating the number of publications and presentations by research trainees, it may not provide the best measure of research training success because it does not attend to the process elements whereby these targets might be best achieved within a local program setting.

Research directors in emergency medicine have recognized research mentorship as one of their primary responsibilities (Karras et al., 2006). Karras and colleagues (2006) surveyed research directors in emergency medicine to determine factors associated with research productivity, defined as publications, number of grant awards, and amount of grant funding. They found that programs with a research director were not more productive than programs

without a research director, but they found the presence of non-clinical faculty, research coordinators, and reduced clinical hours for academic faculty to be associated with productivity.

Program directors with supportive attitudes towards research are associated with successful research programs (DeHaven, Wilson, Murphree, & Grundig, 1997; DeHaven et al., 1998). These authors conducted a 3-stage investigation into what makes a family medicine residency program successful in research, including a telephone survey of program directors, a mailed survey to graduates from selected successful programs, and interviews with program directors and research directors from selected successful programs. DeHaven et al. (1998) classified programs into three categories: 1) relatively undeveloped, 2) developing, and 3) relatively developed. In those programs which were relatively developed, interviewees nearly unanimously voiced the importance of an enthusiastic research champion to encourage and catalyze others to engage in research. Furthermore, in relatively developed programs, residents reported significantly higher levels of awareness of the importance of research, the role of research in clinical care, abilities such as literature searches and research design, and comfort and interest in undertaking another research project.

Unfortunately, research directors in emergency medicine have also reported both low levels of research in the clinical setting and of help from faculty in executing research in the clinical setting (Levitt, Terregino, Lopez, & Celi, 1999). Furthermore, research directors in emergency medicine have reported a lack of support from other faculty in mentoring resident research (Karras et al., 2006). This suggests that wider faculty support might facilitate resident research activity, and may provide particular benefit in executing research in the clinical setting.

Mentorship. Despite survey results from Nasr et al. (2012) which suggested that lack of mentorship may not be a problem in U.S. anesthesiology programs, several authors have

emphasized the importance of strong faculty mentorship for facilitating resident interest and activity in research (Ahmad et al., 2013; Blake, Lezotte, Yablon, & Rondinelli, 1994; Temte, Hunter, & Beasley, 1994). Resident interest in research may be stimulated by exposure to skilled mentors (Temte et al., 1994). Temte and colleagues (1994) surveyed family practice residents in Wisconsin to assess research interest and activity. Forty-eight percent of respondents were interested in gaining research experience during residency, but only 8% were active in a research project. Residents who expressed an interest in pursuing research during residency were more likely to report that their faculty had the required skills and knowledge to mentor a research project. Greater involvement of anesthesiology faculty in research has been correlated with greater numbers of resident publications in the past two years (Ahmad et al., 2013). Specifically, Ahmad et al. (2013) found that those programs which reported >20% of faculty involved in research had greater levels of resident publications within the previous two years than did those programs with <20% of faculty involved in research (36% of programs vs. 15%).

Having a mentor outside the home department has been correlated with lower levels of resident research productivity (Blake et al., 1994). However, the provision of guidelines for residents in choosing a mentor, and the provision of faculty guidelines about the responsibilities of mentorship were associated with a higher level of resident research activity. These authors investigated the impact of structured training on research productivity in physiatric residency training programs, where productivity was measured by the number of completed resident projects per year. High productivity was equated with one or more projects completed in a 4-year residency. The authors surveyed program directors to determine the availability of structured training in research methodology, mentored research experiences, and other support

services. Secondary goals included quantifying resident research productivity and to determine factors that may influence resident research productivity. Similar to recent work in anesthesiology programs (Ahmad et al., 2013), authors concluded that the factors that seem to contribute to higher levels of resident research activity include effective mentoring and a structured (classroom) curriculum in research methodology. They suggested that investment into these two areas might positively influence resident research productivity. A discussion of a structured curriculum for teaching research skills will follow shortly.

Faculty mentorship of resident research may increase completion and publication of projects. Kurahara et al. (2012) assessed resident and faculty collaborative publication productivity before and after the implementation of a resident research requirement in a pediatric residency program. The research requirement included didactic lectures on research throughout residency, critical appraisal through journal clubs, faculty mentorship, and the opportunity for residents to present their research. By establishing an expectation for faculty mentorship and collaboration with residents, Kurahara et al. (2012) argued that projects were more likely to be published, because faculty could help with preparation of the manuscript and fielding responses to journal reviewers.

Lack of available mentors has been noted as one of the primary challenges to completing resident research (Silcox et al., 2006; Warnick, Raffel, Glick, AANS, & CNS Section on Tumors, 2003; Yager, Greden, Abrams, & Riba, 2004), and a source of dissatisfaction with research training (Hsu, Tabaee, & Persky, 2010). Lack of mentorship from faculty may be attributable to a lack of perceived competence in research mentoring among clinicians (Jayasundera, Fisk, & McGhee, 2003). However, lack of available mentors can be a significant detriment to residents' level of satisfaction with research training (Rios Zambudio, Sanchez

Gascon, Gonzales Moro, & Guerrero Fernandez, 2004). The evidence points to the importance of strong faculty mentorship to facilitate resident research.

Structured curriculum. Research training can be structured or unstructured. However, DeHaven et al. (1998) found that relatively developed research programs were consistently described by interviewees as "well structured." Furthermore, structured programs have been found to be more likely to be an influential learning experience (Leahy et al., 2008). Structured programs have been found to increase resident research activity (Blake et al., 1994) and productivity (Ahmad et al., 2013; Millis et al., 2004). Methodological research knowledge, self-assessed research competence, and number of publications and grant applications have all improved after a 1-year curriculum (Lowe et al., 2007).

Structured programs, defined as those which included a research rotation, were more likely to have >20% of residents with a publication in the past two years than were programs with unstructured research programs (Ahmad et al., 2013). In other words, 40% of structured programs had >20% of residents with a publication in the past two years, whereas only 14% of unstructured programs met this standard. Furthermore, a classroom curriculum has been associated with a higher level of resident research activity, defined as the completion of one or more resident projects in a 4-year residency (Blake et al., 1994).

Characteristics of programs reporting a structured research education during anesthesiology residency in the U.S. included a research curriculum, required participation in research, presentation and writing skills training, and the presence of a research assistant (Ahmad et al., 2013). However, in this survey of 131 anesthesiology program directors (74% response rate), expectations were not significantly different between those residencies that offered a structured education program and those that did not, perhaps due to the fact that the authors

distinguished a structured research education program as one that included a research rotation (protected time for research activities). Expectations in both types of programs included journal club presentations, departmental educational presentations, national meeting presentations, and manuscript preparation and submission (Ahmad et al., 2013).

Several suggested research curricula have been published (Boninger et al., 2001; Kenton & Brubaker, 2007; Lowe et al., 2007). Recently, Kenton and Brubaker (2007) surveyed program directors to determine how obstetrics and gynecology programs incorporated research education into their training programs. Their 15-question survey was administered to a sample of obstetrics program directors in Canada and the United States, gathered from those attending the Association of Professors for Gynecologists and Obstetricians Annual Meeting in March 2006. Sixty-two percent (132/213) of residency program directors completed the survey. Ninety-five percent of programs required residents to complete a research project for graduation; however, only 33% of these programs with a research requirement provided a specified research rotation. The majority of programs had regularly scheduled journal clubs and used an apprenticeship model for research education. Authors concluded that a formal research curriculum may accomplish program directors' primary goal of interpreting the published literature, and may also increase number of academic obstetricians and gynecologists. However, these conclusions seem premature based on the scope of their study. The authors call for future research into the development and validation of a research program for obstetrics/gynecology residents.

A one-year training program in clinical research was administered to a small sample of residents from various specialty programs in Germany. The purpose of the study by Lowe et al. (2007) was to investigate the effectiveness of a one-year resident training program in clinical research. Research was conducted as a controlled before-and-after study using mixed methods.

Measurements were collected from both the intervention and control subjects at the beginning and end of the 1-year training program. Variables examined included methodological research knowledge, self-assessed research competence, number of publications and grant applications, and evaluation of the training program using quantitative methods and a qualitative focus group. Of the 20 residents who enrolled in the training program, 15 completed it. There was no qualitative follow-up with drop-outs to determine areas for improvement. Authors concluded that the one-year training program in clinical research can improve research knowledge and self-assessed competence. It also led to increased research productivity. Focus groups with those who completed the clinical research training raised lack of time as the most frequently cited barrier, which is congruent with several other studies (Hebert et al., 2003; Nasr et al., 2012; Silcox et al., 2006).

Structured programs have been found to increase knowledge and skills of trainees (Rydman et al., 1994), and lack of a research curriculum has been identified as a barrier to resident research (Rivera, Levine, & Wright, 2005). In general, teaching research to trainees has been demonstrated to increase methodological research knowledge (Lowe et al., 2007; Oxnard et al., 2009), although some differences have been noted in self-assessed competency between genders (Bakken, Sheridan, & Carnes, 2003). Furthermore, the prevalence of poor research training continues to present a challenge to resident research (Aslam et al., 2004; Butt & Khan, 2008; Cronk et al., 2005; Kenton & Brubaker, 2007). Residents do not always perceive their competence to have increased substantially due to research training (Cull, Yudkowsky, Schonfeld, Berkowitz, & Pan, 2003). Knowledge about how to conduct research is a vital component of resident research training, and should be further investigated if residents do not perceive increased knowledge after participation in a research curriculum. The shared

experience of poor research training has the potential to spawn a subculture with underlying cultural assumptions that will negatively impact the organizational goals.

Professional support (statistical, administrative, and editorial assistance). Relatively developed research programs often reported the availability of professional support (DeHaven et al., 1998). In fact, in most programs characterized as successful research environments without resources for a physician research director, the authors found that the research director often had a social science, behavioural science, or epidemiology background. In programs with even more constrained resources, DeHaven et al. (1998) found that interviewees articulated the presence of a research assistant as helpful if that person had some training in research and good communication skills.

Lack of a supportive infrastructure, including access to statistical analysis and research administration, has been noted as a hurdle to resident research (Khan, Khan, & Iqbal, 2009; Roane, Inan, Haeri, & Galynker, 2009). Furthermore, program directors were more likely to identify resources available than were residents, and were more likely to perceive faculty advice as being useful (Silcox et al., 2006). These findings concurred with previous research in emergency medicine, in which residents were unsure whether their department had access to a biostatistician, a research coordinator, or a research director (Terregino, Levitt, Lopez, Eskra, & Arnold, 1999). Discrepancies between residents' and program directors' perceptions of what is offered for research training have been highlighted in several studies (Buschbacher & Braddom, 1995; Silcox et al., 2006; Terregino et al., 1999), stressing the need for increased communication of available resources. This may reflect differences in basic assumptions between subcultures, developed from shared experiences with resident research training.

Protected time. The provision of dedicated time for research has been highlighted by DeHaven et al. (1998) as one of the significant factors in relatively developed research programs. Additionally, Kanna et al. (2006) contributed the success of their research curriculum largely to the protected time provided to trainees for research activities. However, physicians do not consistently value increased training time for research, despite an espoused appreciation for research, as it may detract from clinical training (Leahy et al., 2008; Silcox et al., 2006). In a survey conducted by Kenton and Brubaker (2007), program directors ranked ability to interpret the published literature as most important, and felt graduating residents were well prepared to do so. An understanding of how to design research projects was rated second most important, but program directors reported residents were less prepared to prepare a research protocol, submit a proposal for ethics approval, or write a manuscript.

The importance of protected time on resident research productivity has been discounted by Blake et al. (1994) in their survey of program directors in physical medicine and rehabilitation residencies. They found that protected time was not necessarily associated with a higher level of completed resident projects per year (>1 project/4 year residency). However, the allowance of protected time for completion of research during residency cannot be so easily dismissed. The lack of protected time for research has been the most commonly cited barrier to research in residency (Rivera et al., 2005).

Insufficient time continues to be a major hurdle to resident research (Khan et al., 2009; Lowe et al., 2007; Nasr et al., 2012; Silcox et al., 2006; Warnick et al., 2003; Yager et al., 2004). Scheduling research time for residents is a significant commitment, including costs and logistical requirements of removing them from clinical work (Oxnard et al., 2009). Additionally, residents in the research track at their institution experienced greater difficulty with board certification

exams than clinical-track residents (Hillman & Gay, 2005). Roane et al. (2009) acknowledged the lack of time experienced by both residents and faculty mentors in completing research. However, program directors may not perceive schedule conflicts or lack of time to be as significant barriers to research as do residents (Silcox et al., 2006).

Funding support. Funding for research has consistently been cited as an issue in resident research training, whether as a factor contributing to success, or as a barrier when it is lacking (Khan et al., 2009; Warnick et al., 2003). Research directors in emergency medicine have expressed dissatisfaction with internal funding for research and lack of grant-development support (Karras et al., 2006). In a Letter to the Editor in the prominent journal *Anesthesiology*, Nemergut (2013) recognized the conflict between financial compensation for clinical commitments and research time in anesthesiology programs, since The Center for Medicare and Medicaid Services in the United States only funds resident salaries for time spent in clinical duties, or in research in the hospital setting. Nemergut (2013) called for departments to work on funded research positions to allow residents time for research exclusive of clinical duties. Furthermore, the lack of research funding has been identified as one of the most common reasons Internal Medicine residencies are cited for failure in accreditation (Levine, Hebert, & Wright, 2005). Of their four interventions to improve resident research activity, Fischer and Cation (2005) noted the largest improvement in resident research activity after cost reimbursement and a research requirement were instituted. Although not every resident research project requires funding for execution, the recognition of financial support as a determinant for successful resident research justifies attention to funding as a product of the research culture when looking to improve the research climate.

Satisfaction with research training. Successful research experiences have been shown to increase positive attitudes (Kanna et al., 2006; Leahy et al., 2008; Rydman et al., 1994). Furthermore, resident participation in research has been associated with increased satisfaction with residency training overall (Takahashi et al., 2009). However, satisfaction has not been consistently demonstrated across all residency training programs. Some survey respondents reported that research training has been highly beneficial (Jayasundera et al., 2003) while others indicated dissatisfaction with the research training received (Cronk et al., 2005). In some cases, research training is provided, but inadequate (Aslam et al., 2004), or severely lacking in mentorship (Rios Zambudio et al., 2004).

Resident respondents in internal medicine rated their research training as a "worthwhile experience" (Rivera et al., 2005), but work by Leahy et al. (2008) contradicted this finding in their survey of Canadian family physicians, where only 20% of respondents found their resident research experience to be an influential learning experience. One possible explanation for these conflicting results might be the varying levels of research experience in existing resident research programs.

Although an appreciation for research may be enhanced through exposure to research training in residency (Jayasundera et al., 2003; Kanna et al., 2006), the research training must be appropriate in order to produce positive attitudes and increased knowledge, as demonstrated by three studies from Pakistan (Aslam et al., 2004; Butt & Khan, 2008; Khan et al., 2009). These mixed results emphasize the importance of designing research training that is responsive to resident needs, faculty strengths, and program variation in order to facilitate the formation of shared cultural assumptions that are aligned with organizational goals.

Concluding Thoughts on What Makes a Successful Resident Research Program

Resident research training has the potential to influence research activity, knowledge, positive attitudes and interest in research, clinician-scientist career choice, and rates of publication and presentation. However, this research training must include attention to improving the factors that facilitate resident research and positive research experiences. Having a structured research program with didactic instruction in research methods and design, that is propelled by a research director and supported by faculty mentors, adequate professional staff and research funds will increase the success of resident research training.

Despite the widespread application of research training in various forms during residency, several problems have been repeatedly recognized. Surveys of program directors (Levine et al., 2005) and residents (Rivera et al., 2005) have identified barriers to research training which include limited resident interest and time, lack of faculty mentors and time, lack of resident research skills and research curricula, and inadequate funding. In addition, the amount of time devoted to learning clinical anesthesia and other personal factors have been cited as barriers (Silcox et al., 2006). In a systematic review of resident research curricula, resistance from residents and faculty, and lack of time, experienced mentors and support staff were identified as the main barriers to resident research (Hebert et al., 2003). Furthermore, significant discrepancies between resident and faculty perceptions of research training have been acknowledged (Buschbacher & Braddom, 1995; Silcox et al., 2006). Little has been done to resolve these ongoing challenges, which appear to be pervasive within research training for residents. Therefore, there is a need to explore resolution of these challenges in order to improve postgraduate medical education.

Improvement Initiatives

A few studies have reported attempts by residency programs to address persistent challenges to research training through implementation of various solutions to the identified problems – lack of a structured curriculum (Kanna et al., 2006; Roth, Chan, &, Vohra, 2006), resident time for research and faculty time for mentorship (Brubaker & Kenton, 2011), content and delivery of a research course (Spice et al., 2011), resident research activity (Fischer & Cation, 2005), and academic capacity for research (Tulinius et al., 2012). It would have made an interesting study to consider whether the way in which organizational leadership set the vision for the new initiatives had impact on underlying assumptions of members. In each case, the program was newly developed, rather than housed within existing resident research training that already included the artifacts of a successful program.

Development of a structured curriculum. The development of a pediatric resident research curriculum at the University of Alberta to improve the resident research experience was investigated by Roth et al. (2006). Previously, resident research was encouraged but not required. Based on in-depth interviews with University of Alberta pediatric faculty members and residents, Canadian chief residents, and resident participants in the 15th Annual Pediatric Residents' and Fellows' Research Competition (May 2003), factors thought to influence resident involvement in research were elicited. A structured curriculum was developed to include 1) a required resident research project, 2) a supportive training environment that included protected time, mentorship and research support (librarians and biostatisticians), cash awards for resident research competitions, and a research seminar series, and 3) research funding. The authors evaluated pre- and post-implementation proportions of publication, conference presentation, and grant awards. However, they neglected to evaluate the impact of the curriculum on resident

perceptions of, satisfaction with, or perceived competence resulting from the research training program. Furthermore, they did not investigate whether their interventions enhanced the research culture of the department. In contrast, increased resident satisfaction after institution of a structured research curriculum has been reported by Kanna et al. (2006). The authors reported they followed an improvement model (Avedis Donabedian, 2006). The needs assessment that prompted them to initiate/strengthen aspects of the structured research curriculum was based on results of a survey where internal medicine residents reported dissatisfaction with opportunities for scholarly engagement. However, the authors did not report whether the development of a structured research curriculum was conducted by the researchers or residents themselves. They offered a detailed description of structural, procedural, and research rotation elements of the curriculum. Their evaluation was very structured, including a competency-based assessment by their research director, research rotation evaluations completed by residents, satisfaction surveys, and self-assessed competence surveys of residents. While the authors evaluated several outcomes of the research rotation, this study was seriously lacking in qualitative analysis of resident perceptions and satisfaction with the research rotation to assist in determining local needs and aspects of the research rotation best targeted for improvement.

Research teams. In response to the limited availability of faculty mentors and limited resident interest in conducting research, research teams have been proposed as a solution (Brubaker & Kenton, 2011; Lohr et al. 2006). In a recent commentary, Brubaker and Kenton (2011) reported on the establishment of Clinical Research Education Study Teams in obstetrics and gynecology residency as a response to cited barriers such as time constraints for faculty and residents, lack of resident motivation, and lack of faculty mentors. This structured team approach to research completion established cohorts of four residents each, based on the year of

residency. Each team was mentored by a senior faculty member and a junior faculty member with less research experience. Faculty members were responsible for 1-2 cohorts at any given time, and each cohort had a 4:1 resident-to-mentor ratio. The teams met monthly for an hour, including time for didactic lessons, brainstorming research ideas, and assignment of tasks such as reviewing the literature, designing a prospective trial, ethics application, data collection, analysis, and manuscript preparation. Over the course of a 4-year residency, this allowed 48 1-hour sessions for research, which the authors equated with three master's level university courses. The mentor promptly distributed minutes after each monthly meeting. Kenton and Brubaker (2011) reported anecdotal improvements in residents' completion of research projects, the use of evidence-based decisions in clinical work, dissemination of research results, acknowledgement of residents' work through several research awards, and positive perceptions of the research program. This work offered an innovative and targeted solution to common challenges, which were pertinent in their local residency program. Although the anecdotal outcomes were all very favorable, including participant perceptions of the team approach to research training, they were not collected or analyzed systematically.

Evaluation and feedback of an online research methods course. A comprehensive report of research program evaluation in postgraduate medical education that incorporated participant perceptions and feedback was published by Spice et al. (2011). In their case study of an online research methods course in palliative medicine, the authors conducted a needs assessment that included program directors and residents in Canadian palliative medicine programs, and an extensive evaluation based on the 10 participants from across Canada who had completed it. The results of the post-course survey suggested that the course should remain an optional part of residency training, although online learning was rated useful and quite positively

despite a few technical difficulties and a higher-than-expected workload. Participants had greater comfort with course topics such as ethical issues, challenges in palliative medicine research, and randomized clinical trial design than in statistical tests, but rated the quality of course modules quite highly. Valuable feedback was also gathered in the form of written comments, which highlighted the workload and lack of time as hindering learning. Participants offered suggestions for improvement such as omitting some course content, splitting the material into two courses, or lengthening the timeframe for completion of the course. Authors indicated their intent to modify future offerings in response to learner feedback, such as embedding biostatistical teaching into problem-oriented discussions. The next step, which was not addressed in this report, would be to investigate whether interventions for improvement of the course would be successful in overcoming these problems. Unfortunately, this case study was restricted to evaluating one component of a research curriculum – a course in research methods, and one delivery method (online). There remains the opportunity to evaluate a comprehensive research training program housed in a residency program with face-to-face personnel support.

Collaborative model for developing academic capacity. Tulinius et al. (2012) offered the first collaboratively-designed research training to increase the general level of academic capacity in general practice. Their objective was to develop a mandatory program to increase academic capacity by creating a link between general practice researchers and clinical educators in Denmark. They developed and delivered a research training program using a participatory research process. Tulinius et al. (2012) based their work on the assumption that those who deliver the training must be involved in the continual development of the training. General Practitioners (academic and clinical) established a teaching faculty who determined and developed the curriculum before teaching trainees. Furthermore, changes to program content

were made based on written evaluation by general practice trainees, and graduates have expressed interest in pursuing research ideas. This study used a collaborative model for development of a program to increase general academic capacity, and may provide a good model for using collaborative methods for improvement of an existing resident research training program.

Concluding thoughts regarding improvement initiatives. Previous research has effectively demonstrated the benefits to residents and training programs when research training is well-conducted. Artifacts of successful research training include didactic instruction in research methods and design, the presence of a research director and faculty mentors, adequate professional staff and research funds. Attempts at improving resident research training have included initiatives aimed at the lack of a structured curriculum (Kanna et al., 2006; Roth et al., 2006), resident time for research and faculty time for mentorship (Brubaker & Kenton, 2011), content and delivery of a research course (Spice et al., 2011), resident research activity (Fischer & Cation, 2005), and academic capacity for research (Tulinius et al., 2012).

While it makes good sense that medical educators would have been interested in the factors that contribute to effective resident research training, these investigations have largely focused on integrating the artifacts of a research culture into the development of a new research program. A few studies investigated the espoused beliefs, attitudes, and values of residents and faculty. However, there has been no attempt to uncover the shared assumptions that undergird a research culture in postgraduate medical education, the collaborative engagement of improving existing resident research training, or the impact of change processes on the pre-existing research culture of a residency program. Furthermore, there is limited evidence of integrating local insights with theories of successful research training. How do residency programs, faculty, and

residents interpret and apply the evidence to local research programs? How do these stakeholders perceive the challenges in training residents to do research? And how can program directors, faculty mentors and residents reach congruent understandings of resources that are available to facilitate research training?

A Conceptual Framework for Thinking About Research Culture in Resident Training

In this chapter, I discussed the relationship between climate and culture, and presented a synthesis of the external forces which drive the mandate for resident research training, and the artifacts and espoused beliefs of resident research culture. My intent has been to outline the factors that have contributed to my conceptual framework of the research culture in residency.

The framework offered in Figure 1 includes two important considerations on which to base a study of resident research climate and culture. First, it outlines the three levels of culture in which cultural phenomena are observable: artifacts, espoused beliefs, and deeper assumptions (Schein, 2010). Artifacts of the research culture and espoused beliefs about research training make up the climate of a research training environment. Artifacts of resident research training include a structured curriculum, the presence of faculty mentors, professional support, and research directors, protected time for research, publications and presentations, and funding. Espoused beliefs surrounding resident research include the attitudes which support or undermine successful research cultures and the level of satisfaction expressed by various actors. The main implication of outlining these three levels of culture for this study is to demonstrate that previous work has focused largely on integrating artifacts of successful research cultures and on identifying espoused beliefs of the involved actors. The underlying assumptions of research culture in these settings have not been described.

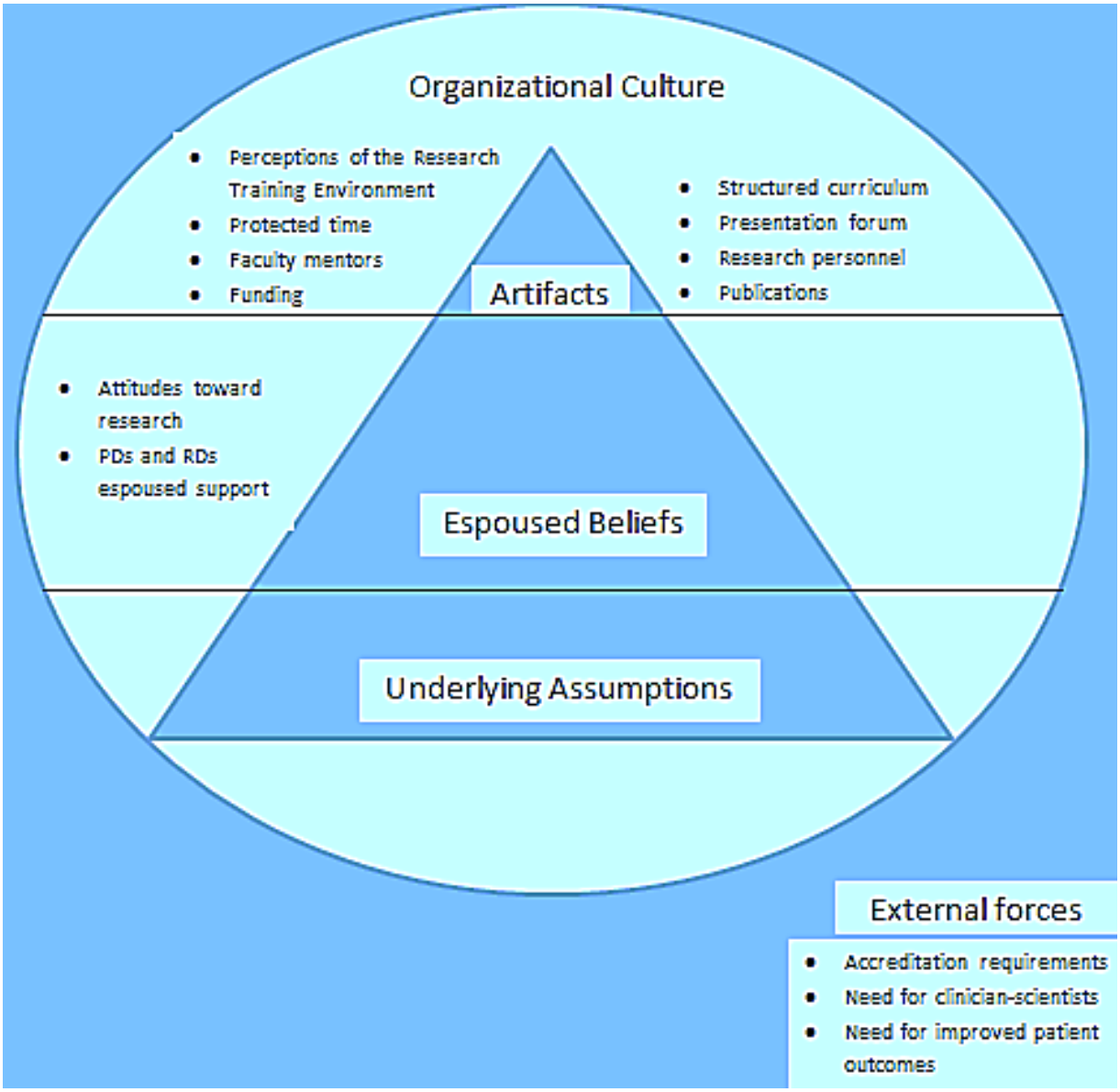

***Figure 1*: A framework for thinking about research culture in residency training.**

Second, the framework recognizes the external forces which drive resident research training, including the scholarly mandate set forth by accrediting agencies, the need for clinician scientists, and the call for improved patient outcomes.

By considering improvement of resident research training through a lens of organizational culture, I hope to contribute to existing theory by illuminating the underlying cultural assumptions in a Canadian resident research program in anesthesiology.

Concluding Thoughts and Future Directions

In considering the dominant research methods that have been employed in studying resident research training, one could conclude that investigations have largely occurred through the use of surveys, controlled before-and-after studies, pre- and post-tests, reviews (systematic and otherwise), and case study methods. A few studies have utilized interviews and focus groups to obtain the perspectives of trainees. However, the current state of knowledge on research training in postgraduate medical education lacks a model for application and implementation of factors to increase training success. Resident research training should reflect the goals and aspirations of both residents and program faculty, and be grounded in shared cultural assumptions. There is limited evidence of resident research training improvement within a participatory paradigm, and no examples of overcoming obstacles to an existing resident research program through a collaborative improvement approach. Educators are left without a model for collaborative program improvement of resident research training that incorporates both quantitative metrics of success, and qualitative analysis of participants' perspectives. There is ample opportunity for a study that collaboratively applies the established elements of a successful resident research to a local research training program. A theoretical approach to the problem that co-generates knowledge based on shared understandings and research evidence to achieve local objectives may contribute to resolving common challenges.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

The purpose of this action research study was to understand the research training climate in anesthesiology at the University of Saskatchewan, and to collaboratively determine strategies for addressing persistent challenges to resident research training. A three-phase, sequential mixed methods design was employed to: 1) identify the shortcomings in the research training climate, 2) explore resident and faculty perceptions of the underlying reasons for these shortcomings, and 3) explore the impact of the co-generated solutions initiated as three sequential action research cycles. For the purposes of this study, the research training climate was defined as resident and faculty perceptions of the research training environment, and a tangible artifact of the research culture in postgraduate medical education previously described elsewhere (O'Brien, 2013).

This study was designed to answer the following research questions:

1) What shortcomings in the research training climate will be identified by residents and faculty in anesthesiology at the University of Saskatchewan? (Quan)
2) When afforded the opportunity to collaborate in improvement of the resident research program, what three interventions will be proposed by residents and faculty to achieve the ideal resident research training environment? (Qual)
3) What can action research, as a dialectical process of co-generating solutions to practical challenges, offer to our understanding of research training in residency?
4) What we can learn about the research culture of this post-graduate training program in anesthesiology?

This chapter is organized in the following way. First, a description of action research methodology is offered, including the theoretical foundations, its relation to organizational learning, and current applications to orient the study. Next, the dialectical relationship between local knowledge and research evidence is described as the mechanism for knowledge generation in action research. This chapter concludes with an outline of the methods and procedures of the study.

Theoretical Foundations of Action Research

Action research is a systematic means of inquiry aimed at improvement, in which the researcher is oriented as an insider within a particular practice setting, and the main purpose is to solve a local problem of practice (Herr & Anderson, 2005). Reason and Bradbury (2006) offered a definition of action research that brought together action and reflection, theory and practice, while participating with others in problem-solving. The participatory element "affirms people's right and ability to have a say in decisions which affect them" (Reason & Bradbury, 2006, p. 10). Greenwood and Levin (2007) pragmatically extended this definition of action research by describing it as "a set of self-consciously collaborative and democratic strategies for generating knowledge and designing action in which trained experts in social and other forms of research and local stakeholders work together" (p.1). The term action research was first coined by Kurt Lewin (1946) to describe a strategy for integrating theory and practice to achieve a specific goal, or solve a particular problem.

Lewin is further credited with contributions to the early theory of action research which included studies of relations between groups and change processes therein, and shifting the researcher's role from that of a distant observer to an active participant in problem solving (Greenwood & Levin, 2007).

Lewin (1946, p. 44) described the early epistemological assumptions of action research by challenging the uni-dimensional notion of scientific theory (laws), which he saw as a "linkage between hypothetical conditions and hypothetical effects." He went on to explain his perspective:

> These laws do *not* tell *what* conditions exist locally, at a given place at a given time. In other words, these laws don't do the job of diagnosis which has to be done locally. Neither do laws prescribe the strategy for change. In social management, as in medicine, the practitioner will usually have the choice between various methods of treatment and he will require as much skill and ingenuity as the physician in regard to both diagnosis and treatment. (p. 44)

This position is aptly summed up in the action research catchphrase attributed to Lewin: "The best way to understand something is to try to change it" (Greenwood & Levin, 2007). Lewin (1946) proposed "a circle of planning, action and fact-finding about the result of the action" as a method of undertaking action research (p. 38). Other action researchers have proposed similar cycles of planning, acting, observing, and reflecting (Kemmis & McTaggart, 1988) or looking, thinking, and acting (Stringer, 2014). In each of these cycles, the link between action and reflection on action, between practice and theory, is readily apparent.

Bargal (2006) attributed six principles of action research to Kurt Lewin, based on his writings (Lewin, 1946, 1948, 1947, 1951). These are as follow.

1. Action research combines a systematic study, sometimes experimental, of a social problem as well as the endeavors to solve it.
2. Action research includes a spiral process of data collection to determine goals, action to implement goals, and assessment of the results of the intervention.
3. Action research demands feedback regarding the results of the intervention to all parties involved in the research.
4. Action research implies continuous cooperation between researchers and practitioners.
5. The small group plays a central role for decision-making and for achieving change in people.

6. Action research takes into account issues of values, objectives and power needs of the parties involved.

7. Action research serves to create knowledge, to formulate principles of intervention and also to develop instruments for intervention and evaluation.

8. Within the framework of action research there is much emphasis on recruitment, training, development, and support of the change agents (the trainers). (p. 381)

Inspired by Lewin's action research philosophy, Argyris and Schön (1978) developed a theory-of-action perspective to explain why individuals behave in certain ways within organizations. Their goal was to help individuals break free from organizational norms (what they described as single-loop learning) by questioning norms, values, and underlying assumptions. They described two kinds of organizational learning. Single-loop learning is focused on organizational effectiveness, whereas double-loop learning investigates organizational norms that shape existing processes and behaviours (Argyris & Schön, 1978). Their approach combined the discovery of problems with inquiry into the underlying cultural values and assumptions that contributed to these problems, and the creation and implementation of solutions to those problems.

Co-generating Knowledge for Action

The generation of knowledge in action research is a process which occurs through dialogue between "local insights and the understanding that the outsider brings to the table" (Greenwood & Levin, 2007, p. 102). One party offers a proposition, which is then met with challenges and counter positions from other participants, and discourse ensues. In this way, a shared understanding evolves. This dialectical encounter contributes to the co-generation of solutions to local problems. When this dialectical exchange is linked to solving a specific problem of practice, "[l]ocal understanding is challenged by research-based knowledge, and

theoretic understanding is evaluated by its ability to make sense of everyday incidents" (Greenwood & Levin, 2007, p. 103).

The Role of the Researcher

A "key part of the ethnographic ethic is how we account for ourselves" (Altheide & Johnson, 2011, p. 519). These authors explained that a critical feature of research on culture requires the researcher to acknowledge her role in framing and conducting the research. This is accomplished through reflexive accounting of problems and experience in the research (Altheide & Johnson, 2011). This obligation is appropriately applied both in cultural ethnographies and in situations where the researcher is a practitioner within the research setting.

In action research, the researcher is oriented as an insider within a particular practice setting (Herr & Anderson, 2005). I have been employed as the Research Coordinator in the Department of Anesthesiology since December 2006. To establish process validity, the researcher must frame the problem in a way that promotes ongoing learning and triangulate findings with multiple perspectives and data sources (Anderson & Herr, 1999). My role was that of facilitator and guide, but I emphasized that the plan of action be decided upon collaboratively.

Ethically, the potential for coercion and loss of confidentiality existed in recruiting participants for this study because the researcher facilitated required resident research projects. However, action research emphasizes democratic processes and organizational learning stresses group dialogue to uncover shared assumptions. In action research, the researcher is an active participant in problem solving (Greenwood & Levin, 2007).

A leader wishing to influence organizational learning must get inside a culture to understand it (Schein, 2010). In addition, Schein (2010) asserted that the researcher's role in

exposing organizational culture is to get at the shared basic assumptions and to understand how these assumptions evolve. How, then, can the role of the researcher be addressed in this study?

In qualitative research such as this study, the researcher is often involved in a sustained relationship with participants and the research setting. Creswell (2009) maintained that a researcher must "explicitly identify reflexively their biases, values, and personal background, such as gender, history, culture, and socioeconomic status, that may shape their interpretations formed during a study" (2009, p. 177). In the current study, I was oriented as an insider to the practice setting. Although power may have influenced my relationships with participants, its impact was difficult to resolve because I was subordinate to the Program Director, Research Directors, and faculty as a contracted employee. However, I was responsible for contributing input into resident research evaluations, which placed me in a position of power over residents. Despite these straightforward observations, I was further subordinated to my study participants through socio-economic status as a part-time professional contractor in a department where the primary occupation was that of physician-specialist. In some ways, my membership in the culture was more established than that of junior residents, but I was perpetually somewhat of an outsider due to occupational differences. My educational background has been steeped in the social sciences and critical theory, and my personal values lean toward community organizing and development. This may be contrasted to the educational background of my participants, which was steeped in the scientific tradition, and current models of physician compensation which are individualistic. However, I hoped to share my pragmatic goal of improving the research training environment in anesthesiology with study participants.

Where Are We Now?

The current research has theoretical underpinnings in a pragmatic philosophy with roots in the work of John Dewey (Greenwood & Levin, 2007). The importance of linking knowledge with action is a central tenet of pragmatism, where theory cannot be separated from real-world action and reflection. Knowledge generation is a collaborative, dialectical process which occurs between local insights and research-based knowledge, and focused on a particular problem of practice.

Action research in medical education is not without precedent (D'Eon, 1997; Genn & Harden, 1986; Lloyd, 1991; Otto & Nkanga, 1995; Stark & Mandl, 2007). Lloyd (1991) argued that the perfect study with all variables controlled is not possible to conduct and therefore may tell us very little about the transferability of findings. He proposed action research as an answer to solving local problems of practice in medical education, with outcomes published as a case report. Action research into climates of medical education environments has been suggested to improve the quality of the educational experience (Genn & Harden, 1986). By measuring residents' perceptions of the research training environment, medical educators can gain insight into areas for improvement within a program. Till (2004, 2005) used a measure of educational climate to identify perceived weaknesses in a new curriculum, and to assess student perceptions of actual and ideal learning environment at the Canadian Memorial Chiropractic College. However, Till (2004, 2005) struggled with a method of utilizing the results for educational improvement.

Why Start with Climate?

The educational climate of a medical school is both a "manifestation of the curriculum" and a "determinant… of the behaviour of the medical school's students and teachers" (Genn,

2001, p. 342). This description of climate is congruent with Schein's (2000; 2010) argument that climate is a manifestation of culture, an artifact that one can see, hear, and feel when encountering a new group. However, Schein (2010) has also argued that one must understand the basic assumptions of a culture in order to correctly interpret the artifacts. To fully understand a group's culture, the researcher must "attempt to get at the shared basic assumptions and understand the learning process by which such basic assumptions evolve" (p. 32). Schein (2010) recommended identifying espoused values and underlying basic assumptions through group discussion as part of cultural assessment.

Methods

The specific methods whereby the study objectives were achieved are outlined below.

Study Design

This action research study was approached within a pragmatic paradigm (Greenwood & Levin, 2007; Tashakkori & Teddlie, 2003), using both qualitative and quantitative data. A three-stage sequential mixed methods design was applied to three simultaneous action research cycles. The first stage used the revised Research Training Environment Scale (R-RTES) (Gelso et al., 1996) as part of a program evaluation of the research training program in anesthesiology to diagnose shortcomings in the research training climate. Each of the nine subscales was summed, and mean scores were used to identify the areas of perceived shortcoming.

The second stage employed semi-structured interviews and focus groups to explore participant perspectives on the underlying reasons for these shortcomings, and to generate ideas for solutions to guide three simultaneous action research cycles. The third stage followed the initiation of three action research cycles to explore participant perspectives of the impact of these actions.

Population

The research training program in anesthesiology included 35 residents across five years of postgraduate training. Additionally, there were approximately 60 faculty members in anesthesiology. Although all residents were required to participate in research, faculty mentorship was self-initiated by university-based and community-based faculty who had an interest in pursuing research activities. Therefore, approximately 10 were actively involved in mentoring resident research at the time of this study.

Participants. All current residents in postgraduate years (PGY) 1-5 were asked to complete the quantitative assessment of research training climate, the R-RTES, as part of the program's evaluation. Participants for the qualitative phase were sought from among these respondents and the 10 faculty who were actively engaged in research mentorship. I aimed to recruit at least two residents from each postgraduate year of training (2x5=10 residents) and four faculty mentors, but no one was precluded from participation if they wanted to be included. Gender is reported to describe context and allow the reader to judge transferability.

Selection. A conveniently-selected subsample of participants was selected for the qualitative phase by the researcher who was also the Research Coordinator in anesthesiology. Using tacit knowledge obtained through practice (Schön, 1984), invited resident participants represented both those who experienced challenging and successful research experiences. Invited faculty mentors represented both those with relatively modest and relatively substantial experience in mentoring resident research projects (from experience with a mentoring a single resident research project, up to over a decade of resident research mentoring experience).

Participation. The quantitative phase was intended to be completed by all 36 residents during a teaching seminar on statistics on December 13, 2013. The tool measured resident

perceptions of the research training environment for program evaluation of the research training in anesthesiology.

Following the quantitative phase described above, participants had the opportunity to participate by one or all of the following three options. First, participants could engage in the semi-structured interviews/focus groups, focused on reflexive dialogue, to distill the main challenges and ideas for actions that guided the study. Second, participants could partake in the advisory group, to review findings from interviews and focus groups, and to collaboratively decide upon actions for improvement. Lastly, participants could engage in the follow-up semi-structured interviews to reflexively evaluate the impact of these actions following their implementation. The reflexive evaluation comprised mainly qualitative data with some quantitative data, as appropriate for each of the three action research cycles to measure impact of the study actions.

Data Collection

Resident perceptions of the research training environment were measured using the revised Research Training Environment Scale (R-RTES) (Gelso et al., 1996). The R-RTES was a 54-item inventory with 9 sub-scales (see Appendix A) that was based on Gelso's (1993) theory of the nine ingredients of successful research training environments to assess the research training environment in graduate education in professional psychology. Subscales consisted of 6 items, and measured: 1) faculty modeling of appropriate scientific behavior, 2) positive reinforcement of scholarly activities, 3) early, minimally threatening research involvement, 4) teaching relevant statistics and the logic of design, 5) teaching students to look inward for research ideas, 6) science as a partly social experience, 7) emphasizing that all studies are flawed and limited, 8) focus on varied investigative styles, and 9) wedding of science and clinical

practice. Respondents were asked to rate items using a 5-point Likert scale ranging from 1 – Disagree, 2 – Somewhat disagree, 3 – Neutral, 4 – Somewhat agree, and 5 – Agree.

The first subscale, faculty modeling of appropriate scientific behaviour, asked the respondents to rate the following items: "Many of our faculty do not seem to be very interested in doing research," "Faculty members often invite graduate students to be responsible collaborators in the faculty members' own research," "The faculty members of my graduate program enjoy discussing ideas," "The faculty in my graduate training program is involved in the conduct and publication of high quality research (or theory)," "The faculty members here are quite open in sharing their research with their students," and "The faculty members of my graduate program show excitement about research and scholarly activities."

The second subscale, positive reinforcement of scholarly activities, comprised the following six items: "My graduate program rarely acknowledges the scholarly achievements of students," "The faculty does what it can to make research requirements such as the thesis and dissertation as rewarding as possible," "The faculty here only seem to notice a few selected students in terms of reinforcing scholarly achievements," "My graduate program provides concrete support for graduate student research (e.g., access to computers, travel money for making presentations, research supplies, or free postage for mailing surveys)," "My advisor offers much encouragement to me for my research activities and accomplishments," and "Most faculty do not seem to really care if students are genuinely interested in research."

Early, minimally threatening research involvement was measured by responses to the following six items: "I was encouraged to get involved in some aspects of research early in my graduate training," "Much of the research we become involved in prior to the thesis is organized in a way that is highly anxiety provoking to students," "It is unusual for first-year students in this

program to collaborate with advanced students or faculty on research projects," "During their first year in the program, students take a research course aimed at developing research skills, interests, and confidence," "Students here seem to get involved in thinking about research from the moment they enter the program," and "Much of the research we become involved in prior to the thesis is intellectually challenging and stimulating."

The fourth subscale, teaching relevant statistics and the logic of design, was rated through questions such as "Students in my program receive sound training in how to design and logically analyze research studies," "Statistics courses here are taught in a way that is insensitive to students' level of development as researchers," "The statistics courses we take do a good job, in general, of showing students how statistics are actually used in psychological research," "In my research training, the focus has been on understanding the logic of research design and not just statistics," "We get high quality training here in the use of statistics in applied research, e.g., counseling research," and "Our statistics instructors are generally sensitive to students' anxieties and feelings about statistics." References to 'psychological research' and 'counselling research' were changed to 'clinical research' for the purposes of the current study.

The subscale pertaining to looking inward for ideas was assessed through the following items: "I have felt encouraged during my training to find and follow my own scholarly interests," "The research climate here is one in which students can get in touch with their own curiosity and with the research questions they themselves want to ask," "The faculty members of my graduate program encourage me to pursue the research question in which I am interested," "Some of the faculty teach students that during a phase of the research process, it is important for the researchers to "look inward" for interesting research ideas," " I feel that I need to choose a research topic of interest to my advisor at the expense of my own interests," and "Students in our

program feel that their personal research ideas are squashed during the process of collaborating with faculty members, so that the finished project no longer resembles the student's original idea."

The sixth subscale, science as a partly social experience, was comprised of the following statements: "In general, my relationship with my advisor is both intellectually stimulating and interpersonally rewarding (If your advisor has been newly assigned or chosen, respond in terms of what you expect the relationship to be.)," "There is informal sharing of research ideas and feelings about research ideas in my program," "In my graduate training program there are opportunities to be part of research teams," "There is a sense around here that being on a research team can be fun, as well as intellectually stimulating," "Generally, students in my training program do not seem to have intellectually stimulating and interpersonally rewarding relationships with their research advisors," and "This training environment promotes the idea that although parts of research must be done alone, other parts may involve working closely with other colleagues."

Perceptions regarding teaching about the flawed nature of all experiments were measured in responses to the following statements: "I feel that my advisor expects too much from my research projects," "My advisor understands and accepts that any piece of research will have its methodological problems," "I have gotten the impression in my graduate training that my research work has to be of great value in the field to be worth anything," "Students here are encouraged to at least begin thinking about one or more topics upon which they would like to conduct programmatic research (i.e., a series of studies in which one builds upon another)," "I have the feeling, based on my training, that my thesis (or dissertation) needs to be completely original and revolutionary for it to be acceptable to the faculty," and "I get the impression from

my training that, although a single study does not revolutionize thinking in the scientific community, such a study can contribute a useful piece to an unfolding body of knowledge."

Whether respondents felt the research training environment focused on varied investigative styles was measured through items such as "Because of the diversity of research approaches among faculty members in my program, I would be able to find help learning about virtually any major research approach, e.g., field, laboratory, experiential, qualitative," "Many different research styles (e.g., field vs. laboratory) are acceptable in my graduate program," "We do not receive sound training in my program on applied, practical, and less traditional approaches to research," "Faculty members in my program use an extremely narrow range of research methodologies," "There seems to be a general attitude here that there is one best way to do research," and "During our coursework, graduate students are taught a wide range of research methodologies, e.g., field, laboratory, survey approaches."

Finally, perceptions relating to the wedding of science and clinical practice were measured by the following items: "My training program faculty tends to produce research that is not clinically relevant," "My graduate training program has enabled me to see the relevance of research to clinical service," "The faculty does not seem to value clinical experience as a source of ideas for research," "Our faculty seems interested in understanding and teaching how research can be related to counseling practice," "There is a prevalent viewpoint in my training program that research findings can be used to improve clinical practice," and "in this program are rarely taught to use research findings to inform their work with clients." For this research, 'counselling practice' was replaced with 'practice.'

Following the analysis of the R-RTES, semi-structured interviews and focus groups of 2-4 participants, were conducted with the intention of fostering reflexive discourse (Mazutis &

Slawinski, 2008) to distill the underlying reasons for the shortcomings identified by the R-RTES, and to propose solutions to resident research training in anesthesiology (see Semi-Structured Interview Questions, Appendix B). Morgan and Krueger (1998) maintained that "[f]ocus groups are fundamentally a way of listening to people and learning from them" (p. 9).

Interviews and focus groups were audio recorded for analysis. According to Lewin (as cited in Bargal, 2006), the purpose of data collection is to respond to the problem. Therefore, data collection in this study focused on defining the problems and formulating solutions in response.

Member-checking and collaboration on actions for improvement occurred during each successive interview and focus group. Insight obtained through previous interviews was proposed for reflexive discourse at subsequent interviews and focus groups. It was expected that saturation would occur before 12 interviews and focus groups were complete. Lewin (as cited in Bargal, 2006) believed that the best way of achieving change was through encounters in small groups because the norms and values of the individual are formed by the culture to which they belong. Therefore, changes in individual values and social perceptions could only occur through self-examination in small groups, which contributed to developing new group understandings and norms. This concluded the Observing and Reflecting stages of the action research cycles.

Following analysis of the interview/focus group data, the common themes (shortcomings and actions to guide the study) were presented to an advisory group consisting of the Program Director, Research Director(s), mentors, and residents committed to the common goal of improving the research training for residents. This group collaboratively decided upon interventions to guide the action research cycles. A key characteristic of action research is its emergent design (Herr & Anderson, 2005, p. 70), which was demonstrated through the

discussion of R-RTES results when the collaborative group of residents and faculty settled upon a course of action(s) for improvement through dialogue and group reflection. The researchers' role was intended to be that of facilitator and guide, and emphasized that the plan of action be decided upon collaboratively.

After implementation of the action plan, data collection continued in ongoing cycles of the action research process to evaluate whether there was any improvement to the research training environment. Following the initiation of three simultaneous action research cycles, several interviews and focus groups (until saturation) were conducted to reflect upon the impact of the interventions.

Data Analysis

Quantitative data from the R-RTES were reported as mean scores organized by subscale, and was analyzed by tabulating mean scores and standard deviation for each of the nine subscales and 54 items to identify areas of perceived shortcomings overall. Responses were also compared between junior and senior residents on each of the nine subscales and 54 items because the level of experience on which to base responses varied by length of time in the program. For example, the first year residents will not yet have taken the clinical research methodologies course that is a required part of the program, but they may have viewed early involvement in research more positively because the program had made efforts to improve this item over the past couple of years.

Qualitative data from recorded interviews and focus groups were analyzed according to the reflexive and iterative process described by Halcomb and Davidson (2006). These authors argued that verbatim transcription of interview data was not always necessary in mixed methods research. They argued instead for an alternate form of data management, in which the audio

recorded interviews might be used in combination with the researcher's field notes, as part of a theoretically sound, reflexive and iterative process of analysis. This process involved 1) audiotaping of interview and concurrent note taking, 2) reflective journaling immediately post-interview, 3) listening to the audiotape and amending/revising field notes and observations, 4) preliminary content analysis, 5) secondary content analysis, and 6) thematic review.

Establishing Validity

Anderson and Herr (1999) outlined five validity criteria for action research that this project strove to uphold. Process validity compelled the researcher to frame the problem in a way that promoted ongoing learning and triangulated findings with multiple perspectives and data sources. The action research process was respected by seeking ongoing knowledge about the research training climate in the Department of Anesthesia from the perspectives of residents, faculty and staff. Democratic validity required that the research takes into account multiple perspectives and interests, and was ensured by investigating perspectives of residents, faculty, and staff, set in the larger context of the CanMEDS physician competency role of scholar. The research endeavored for dialogic validity by engaging in extensive critical and reflective discussion with participants, stakeholders, and colleagues. Catalytic validity required that the research re-energize participants and leave them with a sense of transformed practice, and outcome validity addressed whether the research lead to a resolution of the problem and reframed the question in a more complex way that lead to a new set of questions to be addressed. Outcome and catalytic validity were gauged upon conclusion of the research and are discussed in Chapter 7.

Ethical Requirements

This research project was approved by the University of Saskatchewan Behavioural Research Ethics Board. The quantitative phase received an exemption as program evaluation. The qualitative phase was treated as "Above Minimal Risk" due to the power relationship that pre-existed between the researcher and the captive participant population, the potential for coercion to participate among residents, and the loss of confidentiality that pre-existed in the potential participant population due to the nature of the researcher's administrative role in the anesthesiology resident research training program. Particular attention was required around issues of informed consent, voluntary participation, and safeguarding participants from any consequences of participation or non-participation in the research project.

Permission to carry out the research was obtained from the Department of Anesthesiology, Perioperative Medicine, and Pain Management at the University of Saskatchewan. Informed consent for participation in interviews and focus groups was sought from residents at the curriculum seminar in statistics, to be taught by the Research Coordinator on December 13, 2013. The researcher explained the purpose of research training improvement through collaborative action research, and that participation was entirely voluntary. Informed consent was sought from faculty mentors in the Department of Anesthesiology prior to their participation in a semi-structured interview or focus group.

Due to the nature of researcher as an insider in action research, the potential for coercion existed if the residents perceived that participation in the action research would win them favour with the residency program staff and faculty. This was explicitly addressed in the consent form required of all participants (Appendix C), and any evaluations or assessments of residents were made in conjunction with a second evaluator for the duration of the research. Because residents

have several clinical and academic commitments, residents could decline continued participation at any time, and data collected up to that point would have been retained for research purposes.

Anticipated Outcomes

It was anticipated that anesthesiology residents within the College of Medicine at the University of Saskatchewan would raise similar barriers to research training as were found in the literature, including lack of time, lack of faculty support, and lack of resources. However, using action research to go beyond resident-perceived shortcomings into an exploration and implementation of residents' suggestions to improve the research training environment was novel. I expected that working collaboratively with residents and faculty to improve the local research training environment in anesthesiology at the University of Saskatchewan would result in improved attitudes toward research, an improved educational climate, and would serve as an example of action research to be used by other residency programs to improve local practice.

Summary

In this chapter, I outlined the theoretical and historical foundations for action research and related this to Schein's (2010) theory of organizational learning to orient this study within a pragmatic, collaborative, and democratic tradition of solving problems through the co-generation of knowledge. In action research, knowledge is generated through dialectical encounters which draw from participants' local insights and research evidence with the intent of exploring solutions to practical problems. By interweaving theories of culture and climate, organizational learning, and dialogical generation of knowledge to solve problems of practice, action research showed promise for enhancing the research training climate in residency programs.

I have outlined a three-phase action research study using a sequential mixed methods design to quantify the research climate in a single anesthesia residency program as a basis for

collaborative dialogue into the root of the problems and actions for improvement. To accomplish this, current residents in anesthesiology at the University of Saskatchewan were invited to complete the revised Research Training Environment Scale (Gelso et al., 1996) to highlight shortcomings in the research training environment. Results from the R-RTES formed the basis of discussions aimed at identifying the underlying causes and possible solutions in a series of semi-structured interviews and focus groups with a subset of residents and faculty. Upon reaching saturation, data from the qualitative phase were presented to an advisory group consisting of the Program Director, Research Director, residents, and faculty mentors to collaboratively decide upon actions for improvement that will guide the study. This research offered practical solutions for overcoming the challenges inherent in resident research training, outlined a model for conducting action research in residency, and contributed to a theory of research culture in postgraduate medical education.

In the next chapter, I describe the results of the program evaluation phase, where residents were asked to complete a quantitative measure of the research training environment, the R-RTES (Gelso et al., 1996). In Chapter 5, I summarize findings from the semi-structured interviews conducted to explore the underlying reasons for identified shortcomings and to generate ideas for solutions to guide three simultaneous action research cycles. In Chapter 6, I describe the implementation of actions for improvement and present the results of the follow-up semi-structured interviews that were conducted to investigate resident and faculty perceptions of the impact of these actions. In Chapter 7, I highlight the main findings and position them within the existing literature.

CHAPTER 4

QUANTITATIVE RESEARCH RESULTS

This three-phase action research study using a sequential mixed methods design to quantify the research climate in a single anesthesia residency program began with a quantitative component to assess resident perceptions of the research training climate in anesthesiology at the University of Saskatchewan. In this chapter, I report the results of the research training environment scale completed by residents.

Phase 1: Quantitative Program Evaluation

In this chapter, I describe the results of the program evaluation phase where all anesthesiology residents at the University of Saskatchewan were invited to complete the R-RTES (Gelso et al., 1996) as part of a program evaluation of the research training program. First, I describe the sample and report the results of a reliability analysis of R-RTES subscales. Subsequently, I present means and standard deviations for each subscale and individual item of the R-RTES, and compare junior and senior residents' mean responses using t-tests. Two additional analyses are presented within this chapter. First, a comparison of responses to R-RTES subscale 4, Teaching Relevant Statistics and the Logic of Design, is made between attendees and non-attendees of the curriculum seminar in statistics. Second, a comparison of subscale 6, Science as a Partly Social Experience, is presented for first-year residents (R1s) vs. all other years of residency (R2-R5).

Description of the Sample

Upon approval from the Behavioural Research Ethics Board, the R-RTES was administered to 20 residents in training years 1-5 who were present at the Curriculum Seminar in statistics on December 13, 2013. Since the 5th year residents are excused from these seminars,

only two were present. Therefore, the 5th year residents were invited to complete the R-RTES during their group study sessions over the following weeks. Residents in training years 1-4 who were not present at the Curriculum Seminar were also invited to complete the R-RTES over the ensuing weeks. The researcher used personal invitations and reminders, with questionnaires returned anonymously to her desk by participants.

Participant profile. By January 20th, the overall response rate was 30/36. The participant profile is presented in Table 1. Of 30 respondents, 6 (20%) were in the first year of residency (R1), 6 (20%) were in second year (R2), 6 (20%) were in third year (R3), 5 (16.7%) were in fourth year (R4), and 7 (23.3%) were in fifth year (R5). Six of these respondents (20%) did not indicate their year of training, but all of them completed the R-RTES during the curriculum seminar in statistics. I surmised from the sign-in sheet at the curriculum seminar that that these comprised responses from one R1, one R3, two R4s, and two R5s. Responses without specified training year are included in the overall reporting of mean scores, but are excluded from any comparisons between junior and senior residents.

Table 1

Respondents by Year of Training

Year of Training	*n* with Year of Training ID'd	*n* with Year of Training not ID'd	Total responses obtained	Number of possible responses	
R1	5	1	6	6	Complete
R2	6	0	6	7	Missing 1
R3	5	1	6	6	Complete
R4	3	2	5	5	Complete
R5	5	2	7	12	Missing 5
Total	24	6	30	36	Missing 6

Reliability Analysis

Reliability is "the ability of a measure to produce consistent results when the same entities are measured under different conditions" (Field 2009, p.792). The results of a reliability analysis of the R-RTES subscales are depicted in Appendix D.

The Faculty Modelling of Appropriate Scientific Behavior (α = .80), Teaching Relevant Statistics (α = .74), Looking Inward for Ideas (α = .80) and Wedding Science and Practice (α = .82) subscales of the R-RTES had good reliability. The Science as a Social Experience (α = .69) and Focus on Varied Investigative Styles (α = .69) subscales had acceptable reliability. However, the Early Involvement in Research subscale had poor reliability (α = .59), and the Positive Reinforcement (α = .43) and All Experiments are Flawed (α = .40) subscales had unacceptable reliability. For reasons of dubious subscale reliability, and to provide more specific direction in choosing actions for improvement, further analysis focused on mean scores for individual questions.

Mean Scores for R-RTES Questions and Subscales

Subscale mean scores were computed using the six questions in each subscale to identify those that were rated less favourably. Mean scores for each question, organized by subscale, are available in Appendix D. The subscale Wedding Science and Practice received the highest cumulative score from respondents (M = 24.17), while Teaching Relevant Statistics had the lowest score (M = 20.93).

However since a larger response rate was obtained from residents in their junior years, and because of the pragmatic goals of this study, I also report the mean subscale scores split between junior residents, those in training years 1-3, and senior residents, those in training years 4-5 (Appendix E). Junior residents rated every subscale lower than senior residents, with the

exception of Teaching Relevant Statistics; however the difference in this case was not statistically significant (p = 0.223). Junior residents reported significantly lower scores than did senior residents on subscales Faculty Modelling of Appropriate Scientific Behaviour (*M* = 20.38, *SD* = 3.86 for junior residents vs. *M* = 23.50, *SD* = 2.27 for senior residents, p = .047) and Science as a Social Experience (*M* = 22.25, *SD* = 3.13, vs. *M* = 25.00, *SD* = 2.14, p = .037).

Subscale 1: Faculty Modelling of Appropriate Scientific Behaviour

This subscale was one of the lowest-scored overall (*M* = 21.83, *SD* = 3.59), with good reliability (α = .80). The lowest-rated item (after reverse-scoring) in this subscale was "Many of our faculty do not seem to be very interested in doing research" (*M* = 2.48, *SD* = 1.01). However, respondents perceived that most faculty enjoy discussing ideas (*M* = 4.07, *SD* = .64), and are open to sharing their research with residents (*M* = 4.20, *SD* = .66).

Junior residents scored this subscale the lowest of all, and significantly lower than senior residents (*M* = 20.38, *SD* = 3.86 for junior residents vs. *M* = 23.50, *SD* = 2.27 for senior residents, *p* = .047). Junior residents were less likely than senior residents to perceive faculty members' invitation for resident participation in their own work (*M* = 3.13, *SD* = 1.03 vs. *M* = 4.00, *SD* = .54, *p* = .012) and faculty members' enjoyment for discussing research ideas (*M* = 3.81, *SD* = .66 vs. *M* = 4.38, *SD* = .52, *p* = .046).

To determine whether residents who had begun to develop a research idea with a faculty mentor scored these items higher, responses were compared between R1s and other years of training (R2-R5s). However, there was not a statistically significanly difference.

Subscale 2: Positive Reinforcement of Scholarly Activities

The R-RTES subscale for positive reinforcement resulted in a mean cumulative score of 23.00 (*SD* = 2.52), but did not have acceptable reliability (α = .43). The lowest-rated item (after

reverse-scoring) in this subscale was "Most faculty do not seem to really care if residents are genuinely interested in research" (M = 3.37, SD = 1.00). However, respondents perceived the program to provide concrete support for resident research (M = 4.47, SD = .73), acknowledge the scholarly achievements of residents (M = 4.03, SD = 1.25), and that their advisor offered much encouragement for their research and accomplishments (M = 4.20, SD = .76). There was no significant difference between subscale scores for junior residents and senior residents (M = 22.88, SD = 2.55 for junior residents vs. M = 23.25, SD = 1.83 for senior residents, p = .716).

Subscale 3: Early, Minimally Threatening Involvement in Research

The R-RTES subscale for early involvement in research resulted in a mean cumulative score of 23.73 (SD = 2.91), but demonstrated poor reliability (α = .59). The lowest-rated items (after reverse-scoring) in this subscale were "Much of the research we become involved in is organized in a way that is highly anxiety provoking to residents" (M = 3.37, SD = 1.07), and "It is unusual for first-year students in this program to collaborate with advanced residents or faculty on research projects" (M = 3.37, SD = 1.10). However, residents perceived being encouraged to get involved in some aspects of research early in residency (M = 4.67, SD = .06) and to think about research from the moment they enter the program (M = 4.00, SD = .59), recognized that they take a research course in first year aimed at developing research skills, interests, and confidence (M = 4.33, SD = .08), and felt that the research they get involved in is stimulating (M = 4.00, SD = .74). There was no significant difference between junior and senior residents' responses on this subscale (M = 22.94, SD = 3.38 for junior residents vs. M = 24.25, SD = 1.49 for senior residents, p = .309).

Subscale 4: Teaching Relevant Statistics and the Logic of Research Design

The lowest-scored subscale of the R-RTES pertained to teaching relevant statistics and the logic of design (M = 20.93, SD = 3.67), and it demonstrated good reliability (α = .74). Subscale scores were not different between junior and senior residents, although this was the lowest-scoring subscale for senior residents (M = 21.50, SD = 3.92 for junior residents vs. M = 19.63, SD = 2.13 for senior residents, p = .223). The lowest-rated items in this subscale indicated that respondents did not perceive that the statistics courses they take do a good job of showing them how statistics are actually used in anesthesia research (M = 2.97, SD = 1.19), nor did they perceive that they get high quality training in the use of statistics in applied research (M = 3.13, SD = 0.8). Junior residents were significantly more likely than senior residents to perceive that their statistics courses do a good job of showing them how statistics are actually used in anesthesia research (M = 3.31, SD = 1.25 vs. M = 2.50, SD = 0.54, p = .037), and that their statistics instructors are sensitive to their anxieties and feelings about statistics (M = 4.00, SD = .82 vs. M = 3.25, SD = .71, p = .038).

However, the discrepancies between junior and senior residents in this subscale might present a false picture. Because the R5s are not expected to attend the Curriculum Seminars, they were not present at this year's curriculum seminar on statistics where this questionnaire was administered. Attendance at this seminar was largely made up of junior residents (n = 15 junior residents vs. n = 5 senior residents). This seminar is offered bi-annually, and has previously been offered by the former Director of Research. Therefore, I compared scores on the Teaching Relevant Statistics and the Logic of Design subscale between residents who attended the curriculum seminar this year, and those who did not, using an independent t-test (Appendix F). Residents who attended this year's curriculum seminar on statistics rated items more favourably

than those who did not attend, including that statistics courses were taught in a way that was sensitive to residents' level of development as researchers (M = 3.85, SD = .99 for attendees vs. M = 2.90, SD = 1.10 for non-attendees, p = .024), the statistics courses doing a good job of showing them how statistics are actually used in anesthesia research (M = 3.25, SD = 1.25, vs. 2.40, SD = .84, p = .037), and their statistics instructors were generally sensitive to students' anxieties and feelings about statistics (M = 4.05, SD = 0.76 vs. M = 3.20, SD = .63, p = .005). However, it should be noted that item scores were still quite low, and the cumulative subscale score was the lowest of all R-RTES subscales.

Subscale 5: Looking Inward for Ideas

The R-RTES subscale Looking Inward for Ideas resulted in a mean cumulative score of 23.30 (SD = 3.26), and had good reliability (α = .80). The lowest-rated item in this subscale was "Some of the faculty teach residents that during a phase of the research process, it is important for the researchers to 'look inward' for interesting research ideas" (M = 3.47, SD = .63). However, respondents felt encouraged to pursue their own scholarly interests (M = 4.07, SD = .69), pursue a research question in which they are interested (M = 4.07, SD = .69), and do not feel that their personal research ideas get squashed during the process of collaborating with faculty (M = 4.13, SD = .68). Junior residents did not score this subscale significantly lower than senior residents (M = 22.25, SD = 3.30 for junior residents vs. M = 24.13, SD = 2.30 for senior residents, p = .165). However, junior residents did perceive more of a need to choose a research topic of interest to their advisor at the expense of their own interests than did senior residents (M = 3.19, SD = 1.17, vs. M = 4.13, SD = .64, p = .019).

Subscale 6: Science as a Partly Social Experience

This subscale was one of the higher-scored (M = 23.50, SD = 3.19), with acceptable reliability (α = .69). The lowest-rated item in this subscale was "There is a sense around here that being on a research team can be fun, as well as intellectually stimulating" (M = 3.47, SD = 1.01). However, respondents felt their relationship with their advisor is both intellectually stimulating and interpersonally rewarding (M = 4.40, SD = .72), and that the training environment promotes the idea that although parts of research must be done alone, other parts may involve working closely with other colleagues (M = 4.03, SD = .61).

Junior residents scored this subscale significantly lower than did senior residents (M = 22.25, SD = 3.13, vs. M = 25.00, SD = 2.14, p = .037). They also scored the item pertaining to the training environment promoting the idea that although parts of research must be done alone, other parts may involve working closely with other colleagues significantly lower than did senior residents (M = 3.81, SD = .66, vs. M = 4.38, SD = .52, p = .046).

Because the first-year residents had not yet begun the CLR 800 course and its accomplanying tutorial which provides an opportunity for small-group discussion of their developing research ideas, I compared them to residents who had taken the CLR 800 course and tutorial (i.e. R2-R5s). There was no significant differences between cumulative subscale scores, but certain items were scored significantly lower (Appendix G). R1s scored significantly lower than other residents on questions pertaining to opportunities to be part of research teams (M = 2.60, SD = 1.14, vs. M = 3.79, SD = .98, p = .028), and the sense that being on a research team can be fun and intellectually stimulating (M = 2.40, SD = .89, vs. M = 3.63, SD = 1.0, p = .017).

Subscale 7: All Experiments are Flawed

The R-RTES subscale All Experiments are Flawed resulted in a mean cumulative score of 23.90 (*SD* = 2.34), but had unacceptable reliability (α = .40). The lowest-rated item in this subscale was "I have gotten the impression in my residency training that my research work has to be of great value in the field to be worth anything" (*M* = 3.57, *SD* = .86). However, respondents felt their advisor does not expect too much from their research project (*M* = 4.07, *SD* = 1.05), their advisor accepts that any piece of research will have methodological problems (*M* = 4.03, *SD* = .67), and that although a single study may not revolutionize thinking it can still contribute a useful piece to a body of knowledge (*M* = 4.23, *SD* = .57). They also felt that that residents here are encouraged to begin thinking about one or more topics upon which they would like to conduct programmatic research (*M* = 4.23, *SD* = .73).

Junior residents did score this subscale lower than senior residents, although the difference did not reach statistical significance (*M* = 23.38, *SD* = 1.96 for junior residents vs. *M* = 25.13, *SD* = 2.17 for senior residents, *p* = .059). However, junior residents did perceive less understanding and acceptance from their supervisor that any piece of research will have methodological problems (*M* = 3.81, *SD* = .66 vs. *M* = 4.38, *SD* = .52, *p* = .046).

Subscale 8: Focus on Varied Investigative Styles

This subscale was the next-to-lowest-scored overall (*M* = 21.67, *SD* = 3.29), with acceptable reliability (α = .69). The lowest-rated item in this subscale was "During our coursework, residents are taught a wide range of research methodologies" (*M* = 2.83, *SD* = 1.02). Also, respondents did not perceive a wide diversity of research approaches among faculty members that would enable them to find help learning about virtually any major research approach (*M* = 3.13, *SD* = .97). However, they perceived that many different research styles

were acceptable in the residency program (M = 4.13, SD = .63), although there seems to be a general attitude that there is one best way to do research (M = 4.10, SD = .88).

Junior residents scored this subscale next-to-lowest of all, though not significantly lower than did senior residents (M = 20.69, SD = 3.07 for junior residents vs. M = 23.13, SD = 2.42 for senior residents, p = .063). Junior residents, moreso than senior residents, did not perceive a wide diversity of research approaches among faculty members that would enable them to find help learning about virtually any major research approach (M = 2.69, SD = 0.87 for junior residents, vs. M = 3.75, SD = .71 for senior residents, p = .007). Furthermore, junior residents disagreed that they were taught a wide range of research methodologies during their coursework, although this did not reach statistical significance (M = 2.81, SD = .98, vs. M = 3.13, SD = 0.64, p = 0.425).

Because the first-year residents had not yet begun the CLR 800 course, which comprises modules on quantitaive and qualitative research methods and N=1 studies, I compared them to residents who had taken the CLR 800 course (i.e. R2-R5s). However, there were no statistically significant differences between R1s and other residents on subscale or item scores.

Subscale 9: Wedding Science and Practice

Wedding Science and Practice was the highest-scored subscale overall (M = 24.17, SD = 3.34), with good reliability (α = .82). Respondents perceived that faculty value clinical experience as a source of ideas for research (M= 4.33, SD = .66), that the training program promotes a prevalent viewpoint that research findings can be used to improve clinical practice (M = 4.20, SD = .66), that their residency has enabled them to see the relevance of research to clinical service (M = 4.00, SD = .83), and that residents are taught to use research to inform their work with patients (M = 4.07, SD = .87). The lowest-scored item in this subscale (after reverse-

scoring) was “My training program faculty tends to produce research that is not clinically relevant” (M = 3.70, SD = .75). There were no statistically significant differences among perceptions of junior and senior residents.

A Note about Non-Parametric Analysis

There has been considerable debate about the proper tests to analyze Likert-type data, rooted in the issue of whether Likert-type data represents interval-level data, or ordered-categorical data (Jamieson, 2004; Norman, 2010). The analysis above assumed the data to be interval data. However, in recognizing that Likert-type data could be considered as a set of ordered categories, I also ran the non-parametric Mann-Whitney U test for independent samples to compare item responses between junior and senior residents with those obtained through parametric analysis. When analysed with the Mann-Whitney U test, significant differences between junior and senior residents on individual items were maintained except those items within Subscale 4.

The significant differences between junior and senior residents on items in Subscale 4, Teaching Relevant Statistics and the Logic of Design, ceased to be statistically significant when analysed with non-parametric statistics. These items were: statistics courses do a good job of showing how statistics are actually used in anesthesia research (non-parametric p = 0.053 vs. parametic p = 0.037), and that statistics instructors are sensitive to their anxieties and feelings about statistics (non-parametric p = .051 vs. parametric p = 0.038).

Concluding Thoughts

In this chapter, I have described the results of the program evaluation phase, where residents were invited to complete the 54-item revised Research Training Environment Scale. These results suggest that the research training program has overall strengths in wedding science

and practice, emphasizing that all studies are flawed and limited, early minimally threatening involvement in research, science as a partly social experience, positive reinforcement of scholarly activities, and teaching residents to look inward for research ideas. Residents reported lower scores for subscales related to faculty modelling of appropriate scientific behaviour, focus on varied investigative styles, and teaching relevant statistics and the logic of design. However, focusing on individual items within each subscale and paying attention to the differences reported by junior and senior residents may shed more light on shortcomings of the research training environment.

CHAPTER 5

QUALITATIVE RESEARCH RESULTS

The results chapters are laid out temporally. In the previous chapter, I described the results of the program evaluation phase, where residents were asked to complete a quantitative measure of the research training environment. In Chapter 5, I will summarize findings from the semi-structured interviews, conducted to explore the underlying reasons for identified shortcomings, and to generate ideas for solutions to guide three simultaneous action research cycles. I end this chapter with a description of the priorities for action that were collaboratively set by residents and faculty.

Phase 2: Semi-Structured Interviews

The results of the semi-structured interviews with residents and faculty are presented in the following pages. I describe the participants, then present the major themes that emerged from the data with supporting quotes. Efforts were made to include quotes from both residents and faculty where they addressed the same themes or illuminated different aspects of a similar point. Subsequently, I report the actions for improvement of research training that were collaboratively decided upon by residents and faculty at a departmental Journal Club on April 17th, 2014.

Participants

After analysis of the quantitative Revised Research Training Environment Scale (Gelso et al., 1996), I circulated an invitation to residents and faculty mentors on February 18, 2014, soliciting their participation in the semi-structured interviews. Following written informed consent, ten residents and six mentors were interviewed. As depicted in Table 2, resident-participants represented all five years of training: two R1s, three R2s, two R3s, two R4s, and one

R5. Eight were male (80%) and two were female (20%), closely approximating the proportion of each gender in the residency program in 2013-2014: 29 males (80%) and 7 females (20%). The majority of participants had research experience prior to entering the residency program, with one participant having participated in research as an undergraduate student, five participants having completed at least one Dean's Summer Student project during medical school, and two participants having a prior graduate degree. Only two resident participants did not have any prior research experience.

Table 2

Resident Participants in Semi-Structured Interviews

Characteristic		*n*
Year of training	R1	2
	R2	3
	R3	2
	R4	2
	R5	1
Gender	Male	8
	Female	2
Prior research experience	None	2
	Undergraduate research	1
	Dean's summer project	5
	Graduate degree	2

As depicted in Table 3, participating faculty mentors represented novice (50%) and experienced (50%) research mentors. Four were male (67%) and two were female (33%). No mentor-participants had graduate degrees, although two had completed some graduate courses. Three had completed a resident research project during their training, and one had no research training whatsoever.

Table 3

Mentor Participants in Semi-Structured Interviews

Characteristic		*n*
Gender	Male	4
	Female	2
Highest level of research training	None	1
	Resident research project	3
	Some graduate courses	2
Research mentoring experience	Mentored ≤2 resident projects	3
	Mentored ≥3 resident projects	3

General Perceptions of Completing Research in Anesthesia

Resident participants expressed both positive and negative perspectives related to research involvement during residency. Interviewees described the experience of completing research in residency as both "cumbersome" (Triadic Interview 10, Residents) and "satisfying" (Interview 6, Resident). They commented that our program likely had greater support for research involvement than other residency programs.

Research is cumbersome. Residents expressed almost unanimously that research was an additional burden on top of an already heavy clinical and academic workload, and that it was of lesser priority than clinical work and teaching commitments.

> I find that you're busy from 7am-5pm at work, then you're trying to coordinate a meeting with… people who are working on the project with you. You're getting to the emails late at night, then things don't get done because nobody read that until the next day, then it gets forgotten about. So it's hard to make those meetings, get everything done in a timely manner because you've just got lots of other things to do…
>
> It's just the way research is – it's a full time job, and we already have a full time job. (Triadic Interview 10, Residents)
>
> Given the clinical duties that we have to do at the same time, and all the other academic roles that we're fulfilling at the same time, research is the easiest to put on the

> backburner. I find that even though I know I have to do research as a mandatory part of my residency, it's the hardest part to accomplish. (Interview 1, Resident)
>
> …because the focus of our lives is clinical work. So, research is the second child in our minds, and that's just the way it is. (Interview 6, Resident)

Research is satisfying. Despite viewing research as a cumbersome addition to academic and clinical duties, residents also viewed it as a source of satisfaction. Taking a project from start to finish in a few years, and having something relevant to present at conferences was seen as a great source of accomplishment.

> Satisfying, I guess, if I had to use one word... Yeah, I guess satisfying, that you could take a project from beginning to end, and do that in two years, and still accomplish your clinical duties, and at least have some quality, I think, to your research that you can either publish it or present it somewhere. Yeah, very happy about it. (Interview 6, Resident)

We have a lot of support for research. Despite sentiments that research is cumbersome, there was an acknowledgement that research is easier in our Department because of the level of support offered to residents. Specifically, it was felt that the Research Coordinator (also the author) facilitated resident research in this regard by providing reminders to push projects forward. Also, the faculty who do research were perceived to be great role models, and the wider faculty was seen as very approachable and willing to discuss ideas.

> When we can show up to our [College of Medicine] resident research day and we can have 1/3 of all the projects that are presented there, and know that we've done the best job we can of them, it's easy to demonstrate how our department has a support network that others don't... But all of us present, and in talking to other residents from other departments, I know that we had far more support than they did, and I think that support mainly came from you in your position. (Interview 6, Resident)
>
> I feel like we're well-supported, …the people who do it and do support you are awesome... When you talk to [the Research Director, former Research Director, or the Program Director], you throw out an idea and they are like, that's been done... The guys who are in academia and do research, they read all the time. They are always reading. And you have to, to stay on top of things… He's so good at it… (Triadic Interview 10, Residents)

> I would reiterate that our department is strong in research. It is a part of our Royal College mandate, but beside that, we're doing bigger research than other schools that are doing a lot of file reviews and get away with smaller research studies. It's good that there's a lot of staff support of residents. Staff in the OR are willing to bounce ideas around; you can solicit opinions, solidify questions because our knowledge base is not as big as theirs. Sometimes it's hard to know if this is a valid question, if it's already been answered, if it's important. But asking the different staff and asking their opinions helps guide your thinking. [broadly, not just staff that are actively engaged in research]
>
> I think there's lots of ideas, lots of different people that you can go to depending on your interests, or if you have no specific interests, there is a wide field to pick from… For a small institution we have quite a wide range of research opportunities available. (Interview 5, Resident)

However, one interviewee took a broader view of the institution in his perception that we are not a research-intensive university:

> Overall at the institution, it seems difficult for residents to find a question, supervisor, and proceed in a timely fashion... I don't think we're all the way to where I would think we would be if this were a major research university… I would imagine that there would be clinical investigators who designated a significant proportion of their time for doing research and residents would be able to get involved with those instructors to facilitate them doing their own research underneath them. There may also be more resources as far as nurse researchers go, to help residents get the paperwork done for their projects so it's not so onerous that way. I feel that we kind of lack that extra step to help research flow for residents... (Interview 1, Resident)

To summarize, resident interviewees expressed frustration with the expectation for research in addition to the heavy clinical and academic expectations. However, they saw it as a source of satisfaction and recognized that their environment was such that they were better supported than other programs in terms of faculty interest, administrative support, and research opportunities.

General Perceptions of Mentoring Research in Anesthesia

Faculty mentors described the importance of resident motivation and enthusiasm. More experienced faculty mentors described an awareness that learning clinical anesthesia was residents' primary goal, and that research ranged from "an interesting addition" to training, to "a dragging distraction" (Interview 3, Faculty). Both novice and established mentors alike

expressed an appreciation for the level of organizational support for research, and new mentors especially, expressed positive perspectives about their experiences.

Importance of resident motivation. Both novice and experienced faculty mentors described the importance of resident motivation for getting research done. Positive mentoring experiences were often attributed to enthusiastic residents.

> A lot of it depends on the resident. If you have a resident who is really motivated like [two residents who I supervise], it's a breeze. You don't have to really do much of anything. I guess I do supervise [another resident] as well, and that would be the other extreme where it's a lot more difficult because there's a lot less self-motivation to get it done. (Triadic Interview 8, Faculty)

> …Having an enthusiastic resident that is keen to work and gets things done in an extremely timely fashion, who is enthusiastic about the project and wants to see this be successful. (Interview 7, Faculty)

Recognition that clinical anesthesia is the primary goal. While faculty mentors emphasized the importance of resident motivation, they also recognized that the primary goal of residency is learning clinical anesthesia.

> Most of them are here to learn clinical anesthesia and that's their primary goal/drive/thrust. So some see this as a nice interesting add-on, and some see it as a dragging distraction that just takes up their time. But there aren't many of those; most of them have pretty positive attitudes to their research project… The whole business consists – for the laggards – of continual reminders, and for the non-laggards, of them perhaps reminding me – have I got things signed that they need signed, and so on and so on. And ones who just simply get things done, have things ready on time, and they are organized and hard-working. (Interview 3, Faculty)

Appreciation for organizational support. New mentors, especially, described their mentoring experience as better than expected, and attributed this to the organizational support for research that was not available to them during their resident research projects.

> Compared to what I expected, with my previous research exposure, I did expect a bit more administrative burden, and that hasn't been the case. I found it to be very little time commitment compared to what I had expected. And that because of the resources…, that I have really just been able to be more creative with it, than necessarily having to jump through a lot of hoops. So I've been very happy with that degree of aid that we've had… I find it actually quite interesting to work in a group,

> including a resident and another faculty; it just a fairly stimulating experience. (Interview 4, Faculty)

> Looking back to how research was when I was a resident to compare how it is now, the main strength is that we have a research assistant who knows what they're doing, which we didn't use to have… (Interview 7, Faculty)

In short, faculty mentors stressed the importance of resident motivation for getting research done, and recognized that learning clinical anesthesia was residents' primary goal and research was secondary. In addition, faculty mentors expressed an appreciation for organizational support of research, including administrative support.

Strengths of the Research Training

Interviewees highlighted several strengths of the research training environment, including approachable and enthusiastic faculty, including research directors and those who are established research faculty, as well as those who are part of the broader faculty base. Other strengths of the research training program were identified as its mandatory component, a supportive program director, protected time, and research coordinator support.

Approachable, enthusiastic faculty. Interviewees clearly indicated they perceived wider faculty support for research; this was not restricted to the "go to" research mentors. Both community and university faculty are willing to discuss ideas.

> Although most the faculty are not involved in research, most of them are supportive of research and are willing to countenance it in their practice... And then there are some who are stalwarts as far as coming out to Journal Club where people present their ideas and comment on them. (Interview 3, Faculty)

> Even though sometimes the staff who do research are limited in the number of how many of them do it, and are really engulfed in what they are doing…they are more than willing to talk to you about an idea, and… encouraging you to take it on and help out with it. Whereas some of the other centers with big-time researchers who've been published or have won awards, you could email them, if you go to their door, if you basically beg, they are moreso like "go away." (Triadic Interview 10, Residents)

> Being in the OR and working with staff, you can always bounce ideas off of them or solicit ideas from them and they're always happy to point you in the right direction if

> they don't have the answer, to help you sort of solidify questions because right now our knowledge base is obviously not as big as theirs. So it's hard for us sometimes to know "is a valid question, has this already been answered, is this important? But asking the different staff and soliciting their opinions helps you guide your thinking. (Dyadic Interview 11, Residents)

> Our Research Directors… is very present (seemingly omnipresent) with regards to his support of research. And then other faculty members – not as many – but a few faculty members seem at least pro-research… [For example], his role is a little more hands-on in terms of actually talking to you about your research project as an individual and what does your project mean. I know that, personally, when I was coming up with my various ideas, some crazy and some more practical, I think he would be the first person I would honestly approach and he provided honest feedback, to flesh it out more, address goals, address objectives, address how you could actually do that project, and was it feasible? And then provide some encouragement and direction with regards to who an appropriate supervisor might be. (Interview 6, Resident)

"Go to" faculty with established research interests/programs. Although resident-interviewees perceived a broad support for research among faculty members, they commented that there is a core "go to" group of researchers within the program. These core researchers provide a wide range of projects to choose from, and make it easy to get involved in research projects.

> Very strong faculty research is one of the big strengths of this program, to be honest. I know it's a core group of individuals who have a lot of research projects and a lot of research students on the go, but I think part of that helps put us on the map. And because they're so strong in their research, it's easy to get started on a project and get going with them. (Dyadic Interview 11, Residents)

Mandatory component. The mandatory nature of the research training was articulated as another strength of this program over other Royal College residency programs. This mandatory component starts early, and includes the Clinical Research Methodologies course (CLR 800) that residents take in their first year, designed to help them conceive a research question, conduct a literature review, and prepare a research proposal. The mandatory component also includes presentation opportunities, and an achievable expectation to disseminate results at a conference, annual meeting, or as a journal manuscript.

> Not all programs have a mandatory research… We make it mandatory and we have an expectation at the end – and it's not a high-level expectation that they're going to publish something in the New England Journal, but that they're going to have something to present at our annual scientific meeting, at Bev Leech. (Interview 3, Faculty)

> I also think the fact that we start early is a big benefit for residents… you kind of start off in first year, and then it's not like you're hammered all the time that you have to get it done. There's not a lot of pressure or very strict deadlines coming up soon. You kind of take it a step at a time, slowly over the course of a few years, so it's more like a marathon than a sprint, which is nice. So I think that's another big strength, starting early. (Interview 5, Resident)

Presentation opportunities provide residents with the opportunity to solicit feedback about their planned study design from peers and faculty, and raise awareness of resources that are available to them, such as statistical support and/or animal research.

> I think one of the big things that helped here… is the presentation of research ideas at the Journal Club because it helps give feedback from an outsider's perspective on your project that you might not otherwise get, because you tend to get... The feedback that we received at the Journal Club was very helpful and changed our study quite a bit. So we were initially going to do a [randomized control trial]… and that changed into becoming a pilot project, or pilot study, or dose-finding study for a future [randomized control trial]. So that all came out of Journal Club… (Interview 5, Resident)

> I think the Bev Leech resident research day is helpful because you actually get to see what other people are doing and it gives you an idea of projects that have been completed, or maybe projects like mine, where there is an upcoming phase to it…. Or even just becoming familiar with the resources available at the University, like [the] study on pig epidurals. I didn't even know that that was something we could do here. I know they do a lot of research with swine in Winnipeg at the University of Manitoba, but I didn't know that was available here. (Interview 5, Resident)

However, interviewees perceived the mandatory nature of the research program as only one component in a larger list of contributing strengths.

> The structure of the research program itself is very much the reason why the culture was easier to establish and why research actually takes place. Research is a pain to do, there's no question about that, and not everybody wants to do it – in fact, the vast majority of people don't ever want to do it. But what we did initially was to establish it as a mandatory component of our training program… Just establishing it doesn't make it happen; people make it happen. [The former Research Director] certainly started it. I think [the current Research Director] is giving himself less credit than he's due, [the current Research Directors] and other people who got involved, certainly created a

> visible persona for the research people in the department. That, coupled with the mandatory component and the research peoples' availability, and certainly [the Research Coordinator's] availability. Every successful program that I have been able to see that is conducting research in Canada… they have somebody who facilitates it at a nuts and bolts level. Without that, it doesn't work. So I think having a mandatory component as an integral structure really helps, then everybody buys in. Automatically, the culture changes even if it wasn't conducive in the beginning. (Triadic Interview 8, Faculty)

Supportive Program Director. Resident-interviewees emphasized the importance of the Program Director, who supports research through the provision of protected time and reminders of research obligations and responsibilities.

> [The Program Director] is very supportive of us as residents, and very supportive of research and the research part of our training… so I think from the leadership of us, it's instituted immediately and supported… [For example], I would look at it as more of a leadership role… [he], being our leader, sort of reminds us, on a regular basis, that we do have obligations to our research project, and to other various forms of research within the department. (Interview 6, Resident)

Protected time. An important aspect for both residents and faculty mentors was the provision of protected time for research activities. Residents felt that they were allowed adequate time to do research, although time was a frequently cited challenge to resident and faculty research.

> I don't think time is a big issue because our department is so flexible in giving us days off here and there. (Interview 2, Resident)

> The department structure – if it does not provide for academic time, if it does not value an academic mandate, if it does not make it possible for clinicians to find some time to do academic work and research. And if the demands are excessive all the time for clinical work, then the structure will not translate. (Triadic Interview 8, Faculty)

Research coordinator support. Residents and faculty expressed appreciation for the contributions of the Research Coordinator in providing reminders, direction for the next steps, problem-solving, and tips based on prior experience.

> Yourself, in your position, is extraordinary… Programs have research directors…; other programs have people like [our Program Director] that at least start by creating an environment. But you can push it, but if you don't have the support network there, such

> as yourself, then the burden falls heavily on the resident, heavily on the supervisor, and heavily on the department to somehow create your research project and help you along the way. …If it wasn't for you and your position of cultivating an environment that is supportive and directive, …such as even helpful reminders of deadlines, helpful reminders of things that are coming up, either internationally… locally… within our department that we can look to, and keeping us focused, because it's easy to get distracted… by clinical work. (Interview 6, Resident)
>
> You very much act as a go-to person for residents, you offer a tremendous insight into the process of study design, and, as much, you really help facilitate that big barrier of getting ethics approval. Ethics approval is difficult, but it becomes less difficult with experience and I think that your experience really helps facilitate that process, because I think that intimidates many, many people. And I think you also offer a lot of experience which many of the research mentors in our program don't have. And I think that you can be the first go-to person to answer many of the resident questions. (Triadic Interview 8, Faculty)
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> I think more, above that course, is sort of the structure, the help that we have within the department. Our research associates, the staff, and then the Research Coordinator position… and then I think we have, with the coordinator as well, is experienced people who have done some publishing. I think that those are the people in the department that others are always going to, to ask them questions, and I think that they're a very valuable resource. But I don't' really know if other departments didn't have that in place, if it would make it a huge struggle. (Interview 9, Resident)
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> When I was a resident, we did all of the… administrative work on our own, filing for ethics, and all that kind stuff. So it was a tremendous amount of work, and developing a protocol as well. Difficult to do while… pursuing the educational aspect of the training program. So providing these kinds of assistance in development is just critical in order for residents to reach their potential, in doing some pretty interesting research. (Interview 4, Faculty)

Residents and faculty mentors listed strengths of the research training environment as approachable and enthusiastic faculty – including established research faculty and members of the broader faculty base, the mandatory nature of research activities, a supportive program director, protected time, and research coordinator support.

Reflections on the Results of the R-RTES

During interviews, residents and faculty mentors commented on the results of the R-RTES (Gelso et al., 1996). These comments clarified and expanded the findings from the quantitative program evaluation phase. These remarks extended understanding around faculty

involvement in research and reinforced a perceived lack of education in statistics and design issues.

Faculty. Comments pertaining to faculty involvement in research extended understanding of the R-RTES results, specifically as they related to faculty attitudes toward research, the number of available mentors, early exposure to research mentors, and mentoring relationships. Where "most faculty" are not involved in research, residents perceived a core group of researchers who were approachable and available to help with resident research.

> The majority of anesthesiologists… don't think of themselves as researchers; we're mostly clinical practitioners. So most of us, perhaps, if I can use myself as an example, really never thought of doing research ever again myself after I finished my residency. Obviously, these opportunities present themselves. (Interview 4, Faculty)

> I think a lot of them [faculty] would want us to be involved with research, but I think there are a lot who would be nonchalant about whether or not we are involved. (Interview 1, Resident)

> Out of 65 anesthetists, there's 5 [mentors]. That's not many; …that's a small percentage… that's 10%... Some like to talk about it, but they don't do it… But even 10 [mentors], that's less than 20%! But I can understand it; if you don't want to do research you can't force it on people. (Triadic Interview 10, Residents)

> I would probably agree … "many of our faculty do not seem to be very interested in doing research." … There's a few "go to" staff for research ideas, that are the most enthusiastic and that would be the most supportive... It's just not the same general sense that you would get from all the faculty across the board. (Interview 2, Resident)

> We've got maybe between 5-8 people in the department who are responsible for the majority of the research…and that's great. So, the fact that we have those people is fantastic for our department. The rest of the faculty don't really discuss [research] that much and I think it's kind of like an unspoken thing that research is those people's thing, they take care of it, that's their deal; we'll do more of the clinical teaching. So it's almost like they've got their roles and they're fine with it… There's a good number, but I would say the majority are not research-focused. It's not a criticism of the program; I think it's just perceived roles within the department. I think we've got more than our fair share of people who are really into research and willing to help. (Interview 5, Resident)

Regarding early exposure to faculty and the development of mentoring relationships, residents remarked that mentoring relationships are slow to start and take time to develop.

> When we filled this out [the R-RTES], I hadn't been in the OR very much; I hadn't seen or met more than 5 or 6 anesthetists… So based on my experience thus far, which was quite minimal, I would have ranked them [faculty members' invitation to participate in their research] a lower score. (Dyadic Interview 11, Residents)

> When you talk about faculty enthusiasm for research overall, I wasn't surprised it was scored low, but …it takes time for [junior residents] to be exposed to more staff and to really get a sense of how many staff there are out there who are interested in research. It may just be a time factor. (Interview 2, Resident)

> My research project, after all of my crazy ideas, came out of [my research mentor's idea] and he invited me… Once you get around a little bit more, you tend to bump into more people doing, I guess, research. (Interview 6, Resident)

> 'In general, my relationship with my advisor is intellectually stimulating and interpersonally rewarding' – and they got a 5 median. That's pretty good! So the ones who are doing research and have the mentors who are interested enough to do it are doing, it sounds like, a decent job… Senior residents saw the whole thing in a more positive light…that's a good thing, I guess... Senior residents felt that it was more their project than their faculty's project… So things, by and large, it looks like all the things that change get better instead of worse, with age and wisdom…That's a good thing. (Interview 3, Faculty)

> You don't have a lot of exposure to working with a lot of staff people until probably the end of your second year because your first year is mainly off-service... I think the more you get to know your staff, the more you can probably pick up on their preferences for research styles, or the things that they like to look for, whether it's someone who bases their clinical practice off solely the best evidence-based medicine, or whether it's people who like trying new things that haven't yet cut the mustard with clinical evidence… In your first year, and even to a certain extent your second year, you're still getting to know the people that you're working with… Once you get more senior, you've gone through the project design, the data collection, the manuscript writing, application, rejection… and eventual publication, hopefully. It does become more of a social thing. You meet in a social setting to discuss plans for the research... It does become a social thing and you spend more time with you preceptor and you get to know them much better. (Interview 5, Resident)

Statistics and research design. Statistics were a much-discussed issue among interviewees, who also commented on perceived limitations in approaches to research design. Reflections on current ways of teaching statistics highlighted strengths and areas of shortcoming.

> The CLR course could be revamped and made far more applicable and useful for residents. There's a lot of information that we get taught and given assignments on that is perhaps not useful. And then the things I feel like I would like to know, or that I would already be deficient coming from medical school into residency in would be

> more of your statistical analysis type questions which we get asked on our ABA [American Board of Anesthesiology] exams, as well as trying to decide what is the best way to analyze our own data in our projects. I feel like I still don't have a good grasp on doing that. We are making some progress with instituting at Journal Club that everybody has to teach one point about statistical analysis, so that's becoming more helpful. (Interview 1)

Comments reflected an acceptance of the status quo, to some extent. Residents learn some statistical concepts through experience, and this was considered somewhat sufficient by interviewees.

> I think statistics is just something – I don't know if it's an anesthesia resident thing, or if it's just people in the medical profession, at least the newer generation – just have a hard time grasping the concepts on…. We're studying for exams now, and I find… certain people are willing to just brush that aside– 'I'm willing to lose those marks' because it's just hard concepts for the people to grasp, whereas, physiology isn't so much. I think the resources that we have and are provided earlier on – it's hard to improve them because I think that we are doing the right things. I think that CLR 800 course is a good course; I think the curriculum seminars we get are good. It's a topic that, because it's so hard to wrap your head around and keep in your head, it's just something you have to continuously go over again and again. So I think Journal Club is a good idea. I think it's a good idea that you brought up– people always joke every time they're about to present their statistics part 'cause '[the Research Coordinator] is making us do this,' but I think that's exactly what we need… (Interview 2, Resident)

> The emphasis in the Royal College I think has been to have two or three very simple statistics questions on the exams and teaching has been aimed at that. I don't know what, if anything, we should do about that. I think once a resident has an interesting idea for a hypothesis, or an idea for a qualitative study, that they'll ultimately learn something about the analysis of it in doing it. But I don't think there's really time to teach them all to be experimental designers and statisticians, realistically. And they're not interested in that unless it's going to be on the exam… There's enough other stuff for them to learn; it's never going to be an important part of the Royal College exams, I don't think. (Interview 3, Faculty)

> The subject itself is not very stimulating. It's hard, before you really start analysing your own data, to really care… I agree I particularly struggle with the retention [of stats]… So is that a function of a failure in our program? Not necessarily. (Dyadic Interview 11, Residents)

> Certainly in my very limited research experience, statistical analysis has been a problem in terms of my understanding. I think that part of the great unknown to people like myself who are pursuing these kinds of projects – including the residents – is statistical analysis… is hard. It seems very daunting, and it seems like something that would be very difficult to grasp. …Most of us have taken a basic statistics class, which can give

> you some really good ideas about odds ratios, confidence intervals, t-tests, and so on… It's just outside of our area of expertise… People who obviously do this as a career take years and years and years to understand and perfect their skills. I think it's partially unreasonable to think you would have no trouble understanding these things. (Interview 4, Faculty)

Furthermore, one faculty interviewee described a lack of confidence in her ability to coach residents in statistical concepts.

> I know nothing about relevant statistics. I can't teach them anything about relevant statistics. So, I would also score poorly if I was doing this. As well as, if they are looking at me as a mentor, they would score very poorly because I don't teach any sort of relevant statistics. I would need a statistician to help me in any meaningful way. (Interview 7, Faculty)

Interviewees commented that there was likely a lack of variety in research approaches, although they recognized projects that employed a variety of approaches.

> I don't think that there would be many different research types of research styles that we use within our department. I know some of us like [another resident] and myself are maybe deviating from what is the usual from our program and doing more survey-type or qualitative research, which I think is probably a little bit new to our department. And I think that the experience of our faculty with qualitative research is very limited, so finding support for other styles of research I guess is… difficult. (Interview 1)

> I'll go back to what I said earlier. We need to definitely value all kinds of research, not just large trials. It's intimidating when you're a clinician, when you're not that well-versed in it, to be expected to do something like that. But if you give somebody a question: 'here's a test that we do. Is it really being utilized?' …I read about all these esoteric tests that are coming out, but do we have something like that here? Do we need to change the way we practice for a quality assurance project? Is pathology meeting the needs of anesthesia and vice versa? Are we doing the right things in the way we utilize blood transfusions? So, a local quality assurance project, let's start with that. And that's easy to get clinicians involved and residents involved. Everybody sees the value right there on the table. (Triadic Interview 8, Faculty)

Reflecting upon the results of the RTES, residents noted that the wider faculty group was generally supportive of research and willing to discuss ideas, but the research mentors were limited. Furthermore, residents and faculty described shortcomings in teaching statistics and research design, expressed a certain level of comfort with the status quo of learning through experience, and highlighted insecurities in coaching residents in statistics.

Short-term Ideas for Improvement

Suggestions for improvement have been organized by the researcher into three groupings. Those categorized as short term ideas for improvement are those which the researcher felt represented the low-hanging fruit – things that could be easily implemented for short-term improvement. Short-term ideas for improvement included encouraging resident collaboration to ease the workload, enhancing communication of research ideas, educating residents and mentors about roles, expectations, and resources, and increasing faculty involvement in research. Following the short-term ideas for improvement below, mid-term and long-term ideas for improvement are subsequently discussed.

Encourage resident collaboration to ease the workload. Residents perceived that collaboration among residents was rare, although they could identify cases where residents did work together. Although encouraging collaboration was mostly endorsed, others felt that it might present new challenges and suggested that there should be a method of holding all team members accountable. Residents did not perceive a universal solution, but suggested that new residents be offered a range of options: new individual projects, to join ongoing projects, and to work in teams.

> Encouraging collaboration…almost encouraging two people on a project versus just one person… Even you guys just saying it. 'We really encourage you to go in groups for this. It's busy, and there's lots of stuff to do. It's useful having two people doing this.' …Looking back, I don't know why I didn't try to talk to [one of my fellow residents] to work together. It's because no one encouraged it! Then I look at [two others who worked together] and I think 'I messed up!' (Triadic Interview 10, Residents)

> I'm sure if I was to join in on something that's already going, then that would be different. I think it would be kind of interesting… It's helpful, even if there's a couple people on the ground, to have someone else to bat ideas off who is not just your supervisor, or to help you with some of the legwork sometimes… collecting samples, or getting ethics approval, or … a phone survey... It does make a difference just to know there's someone else intimately involved in the project… that you can talk to about it... I think it's good to have research as more a social, or a team-based thing. (Dyadic Interview 11, Residents)

> I don't really know of any of the junior residents that are doing projects together. I think everybody is, for the most part, taking on projects on their own. I can think of [one R2 and one R3 who are collaborating with General Surgery residents]. That might make it more interesting and maybe ease the workload, but at the same time that has pitfalls in that you are depending on somebody else to help you get along and you may just end up waiting on another person in order to accomplish a specific task… Somebody always ends up doing more work than the other. (Interview 1, Resident)

> It would have been interesting, at the beginning of the year when we had that meeting about research, to have some of the senior residents, especially if there's some specific people who are like, 'hey, we have this program and we could really use some help.' I would have totally signed [up] right then and there… During the research orientation, to be made aware that there are other projects going on that may need help… (Dyadic Interview 11, Residents)

> For [my project], I know that if we had four other residents on, who were rotating through, enrollment would have gone much quicker… I'm only there a couple times a year, 2 or 3 times a year, maybe… It might be good to allow residents to… do this project… you could probably do it with 4 or 5 residents, but then you'd have to just be able to sort of say how is everyone contributing to this so there's some sort of way of evaluating it so that the programs are satisfied that people are contributing and not getting a free ride through the research component. (Interview 9, Resident)

Enhance communication of research ideas. Interviewees commented that enhanced communication of research ideas would have helped to improve their research experience. This stemmed from their lack of early exposure to faculty and anesthesiology staff who would have the best research ideas. They suggested that having a forum for faculty to present their research interests and opportunities to residents would be helpful.

> I wonder if you can't have a day where all the staff that have a research idea… can get together on a day in an informal setting – once again, like we do our Journal Club, for example – go out to a restaurant and then just give us a 2-3 minute blurb on what your research idea is. It could be literally just a sentence that you have an idea of, or it could be something more well-developed. I think something like that shows that – first of all, it's not in a typical intimidating environment. But then also it shows how many faculty are actually interested in research and that they're willing to go the extra mile to take time out of their schedule to recruit the participation of residents. So something like that being done at a more junior level would be helpful, I think. (Interview 2, Resident)

> If I was to start at beginning, and think of me coming into this program at ground zero: we met you and [the former Research Director], one of our first weeks here, which was great. I think at the same time, having a day like that but getting more other people present, other faculty that are interested in research present to say, "this is what I'm

> interested in. This is what I want to do. This is what we're thinking of." And they have to get to know the residents, because you meet a guy like [an R1 with a PhD], and you go "holy crap! This guy is smarter than most of the people I will ever meet with regards to research." So I think maybe an actual dedicated timeslot to say… to get us a little more involved… Bring in players like you did this past year… Other collaborators like that. I think that was a very good way to at least start that. But getting our own department, maybe a few more people, might be a start… I'm thinking of Bev Leech…when we present to Regina and Saskatoon and whoever else wants to show up, I guess. Instead of us residents presenting, how about staff talk about their interests or their ideas for research. 'Cause some of them are very knowledgeable; some of them have excellent ideas and they're very well-read… I'd be curious, if they came forward and said "look, what about doing something like this, where could we go with it?..." Then I think we, as a department of residents, might feel there's more staff desire to go forward. (Interview 6, Resident)

Education about roles, expectations, and resources. Interviewees, especially one new faculty mentor, expressed a need to clarify program expectations and resources, and to define the research mentor's role.

> I don't know how much time [the residents] get and if it's adequate or not… And then resources are always important... I don't know what the resources are available as far as getting things going, if there is money for– I think [the Research Director] gets money for some of the things he does. I don't know if I wanted a project to do some of the things he does, I don't know if I would know how to get the resources to do that. And I don't know if our department has the means to facilitate some of that. I guess it's just the not knowing. I don't know what our program has and doesn't have, and we probably almost always need more... There's never enough resources, it seems, in my humble opinion… I think most of us have very little idea of what is available. It's a bit of a black hole. (Interview 7, Faculty)

> I don't know if we have any laboratory/bench work research happening here. I would have zero way of accessing it if we did. So I don't know if it's available, if it is, how you get involved. And I trained here, so if I know absolutely nothing about it, that means it was clearly never demonstrated to me. And I'm not telling anybody else about it because I certainly didn't hear anything about it. All I know of what can be done here are survey types or some randomized control trials. That's basically my experience of what is available to be done here. (Interview 7, Faculty)

> I guess I don't necessarily know what my role really is. Can I just be an ideas and clinically-minded person? Or should I have that framework for research? 'Cause I don't have that, so I feel like I'm doing an inadequate job a lot of the time, though I don't really do anything to fix that, so I just go on feeling inadequate about it… To sum that up, perhaps better defined roles as to what the mentors do would be useful, and then having the resources to fill the gaps that they can't fill. (Interview 7, Faculty)

> There's ambiguity in terms of what is the expectations of the resident and the staff…there's also the ambiguity of, in theory, what needs to get done. What are we trying to do? Is it the goal of everyone that you have a paper that's at least publishable at the end? Or is the goal that you collect your data and do stats on it and present it? Is it the goal that you've submitted something to ethics…? And I guess it's hard with research because you can't really make it 'this is what you need to get to.' …I know you can't really do that… but those are areas of ambiguity… Who is responsible for doing the study protocol? (Interview 9, Resident)

More faculty involvement. The perception that current research mentors are reaching capacity motivated interviewees to suggest that fellowship-trained staff be encouraged to mentor research and maintain the connections they established with other centers, staff anesthesiologists be encouraged to get involved in quality assurance projects with clinical implications, and that the program establish a detailed peer-review of research proposals prior to commencement.

> Foster an environment where there is more faculty involvement in research, so that there is a variety of faculty involved as well as a variety of topics that are being investigated. It could make research more interesting given that we do have many people within our department who are fellowship-trained within different areas and it would be interesting for residents who have interests in those areas to pursue research in those areas. (Interview 1, Resident)

> They [fellowship-trained staff] are not following through, yeah… I think that's a valid criticism… All of the Fellowship people, I think, are interested in their area… but there are people who've had to do research as part of their fellowship and then really aren't interested it at all… There probably should be encouragement and protected time for people who have done fellowships to carry on. For one thing, they have contacts, even if they are not really researchers themselves, wherever they've trained, they have contacts with people who are actively doing research, and that should be fostered… They should be given time to know what's going on in [the location where they trained], and can we be part of it and help with it, and can some of our residents do some of that? And I think that they're just so busy with clinical stuff that that doesn't happen. So it should be just a part of hiring someone who has done a fellowship to – at least for the first couple of years, set aside a day/week, a day every couple of weeks with the clear idea that they would be following up on research and research contacts that they've made, wherever they've gone. (Interview 3, Faculty)

> I'm not thinking of a broader base; I'm thinking of having pretty much everybody involved. And how do we do that? That is something so nice to have, when everyone's got something going. So even if it's a QA project, which is what we neglect to our peril. We think that every researcher has to be a master multicenter randomized control trial kind of researcher, and that's a major problem I see with the current research atmosphere. I would very much like to see very small projects given to individuals, and

> say 'hey, you're part of the department; it's one of the responsibilities.' (Triadic Interview 8, Faculty)

Short-term ideas for improvement included encouraging resident collaboration to ease the workload, enhancing communication of research ideas, educating residents and mentors about roles, expectations, and resources, and increasing faculty involvement in research. Next, mid-term ideas for improvement are presented.

Mid-term Ideas for Improvement

The ideas that were categorized as mid-term ideas for improvement were those that would take longer to implement or were beyond the scope of the program to implement alone. Mid-term ideas for improvement included establishing an alternate funding plan that includes financial compensation for academic time, encouraging interdisciplinary collaboration, fostering mentoring relationships, and emphasizing research achievements so more people want to be involved.

Establish an alternate funding plan. Resident and faculty interviewees expressed the need to recognize the value of research through financial compensation. Since clinical work is very well remunerated, research must also be remunerated in order to motivate faculty to take part.

> For me to take time off, just generally, to do this would be unremunerated. I don't know if the drive for me to do that is high enough for me to take unpaid time off to do that when I could just go to work and do what I do. (Interview 7, Faculty)

> It will come down to compensation – being paid to do research instead of clinical duties. (Interview 1, Resident)

> What we need to move toward a more ideal state is very difficult to achieve and requires revolutionary changes: an alternate funding plan that would permit interested researchers to have enough funded time. Now we have more funded time, because of the strange way that we set up our departmental finances, than many departments here. But still, most people make most of their money by doing clinical [work] and billing for it. And most of them can't bill for time spent doing other things… The University is,

> we think, moving in that direction; seemingly, the whole medical school is moving in that direction. (Interview 3, Faculty)

Oddly enough, through these interviews, the researcher (who is also the Research Coordinator) learned that the Department of Anesthesiology currently offers clinical anesthesiologists (i.e. not faculty) some compensation for research time. To be compensated for research time, a clinical anesthesiologist must have a project proposal accepted by the Executive committee. If accepted, the clinical faculty would be awarded a set number of days to work on the project, remunerated through the Department at a rate that is slightly less than a day's clinical pay. However, if the Research Coordinator was not aware of this option, it is unlikely that clinical anesthesiologists are aware. Therefore, there is opportunity to increase awareness of existing opportunities for alternate funding.

> I would also like to see material value being attached to the intellectual value that we give to research. How can we do that? I think we have a precedent in our department; we allocate time on the basis of identified projects, then we take time away once that project is completed. And we have the funds to do that. The university needs to recognize that as well. So, ad hoc allocation of funds and academic time… you get a day; your day is going to be compensated for not too much less than what you would make in the OR. …Come up with a proposal, and then you get the time. This is for the rank and file clinical worker faculty person… This ties into the first comment about structure; this is what we did at an executive level… There's such a thing about putting it in minutes, and mentioning it at a meeting, and the people knowing… My guess is people would say 'well, I didn't know that.' The vast majority of people would probably say that. (Triadic Interview 8, Faculty)

Encourage interdisciplinary collaboration. Interdisciplinary collaboration (with other specialties, sciences, graduate students, and statisticians) should be encouraged as a way to open new opportunities for laboratory research, new mentors, new research ideas, and working in teams to reduce the burden on residents.

> I wonder if there would be a benefit to try to get collaboration with other departments…. I just think it's a neat idea because I just heard [our Research Director] talking with some of the other general surgeons, for example, for ideas for Peds anesthesia. So I think collaboration with other departments would be beneficial as well. When you bring someone from a different specialty, they just have different insights

into things, and maybe completely new research ideas that you didn't think of before. (Interview 2, Resident)

We could collaborate with Health Sciences. Maybe we don't necessarily need an anesthesia staff; we could work with grad students to come up with a good clinical idea, and they have skills for refining projects. (Triadic Interview 10, Residents)

For anyone more interested in basic lab research, I wish we were affiliated with a lab. (Dyadic Interview 11, Residents)

For betterment of the program… probably the best part of my research was, once my research was essentially done, and into [the manager] of hematopathology, who I probably should have found at the very beginning and I just didn't know she existed. I didn't go looking for her, but I didn't really know that she would have been there in the first place. So, I guess from a team standpoint, this is a person that I consider now part of my team because she's now one of the co-authors of my research that I presented in Denver, and hopefully will present in Newfoundland. She was integral at getting me into Denver because I wouldn't even have thought of it in the first place, to present at a transfusion medicine conference. And so I think more encouragement to actually realize that you can be part of a team and you can be a collaborator, not just in anesthesia, but think bigger than anesthesia, think we are part of a surgical team, so are there nurses that could be involved? Are there surgeons that could be involved? From my standpoint, it was transfusion medicine that all of a sudden, I was like, 'wow, someone actually cares about this! This is important to someone other than me! And this is important that I could actually change stuff!' (Interview 6, Resident)

We need to get comfortable using other colleagues/resources who have that [statistics] experience. (Interview 4, Faculty)

One faculty member listed specific ideas for increasing interdisciplinary collaboration:

I think also the opportunity for interdepartmental involvement. So I think I fell into this kind of haphazardly, and it's good for my department, my division, it's good for your department, but I don't know if that's widely advertised to other folks like perfusion, surgery, emerg[ency]… So maybe more of a interdepartmental intro to research, and to kind of think about where you could link up with people, 'cause I think when I came to that intro to research day [the Research Orientation], and was excited about things, and was like, 'think about what you guys could do with my department,' that was kind of cool, right? And then residents probably wouldn't have thought of doing a collaborative project between transfusion and anesthesia, otherwise. So if you had a few other excited folks from other departments or divisions come in and just say, 'just think about it; you guys interact with us a lot. If you have an idea, come to me.' That would help grow the research scope. (Triadic Interview 8, Faculty)

Foster mentoring relationships. Mentoring relationships, in many forms, were highlighted as an idea to leverage improvement of the research program. Interviewees suggested faculty-faculty, faculty-resident, and senior resident-junior resident mentoring.

> I would have a mentor who would guide me, in just general basic research, and then would also help me mentor a student who doesn't end up like me, who has curiosity and zero framework. Yeah, I think that'd be a great idea actually. (Interview 7, Faculty)

> Encouraging meeting outside of work in more of a social setting with pretty much everybody's preceptor because then I think you become more comfortable working with them, and if you have questions you are more likely to go to them for help… Something like that, I think is very conducive to developing that social aspect of research, and making it more than just work that you have to do, or something that you have to complete. I think that has to be fostered within the staff… Encouraging more… camaraderie, like not having that dichotomy of you're the student and I'm the preceptor… you're collaborators; you're working together. Both of your names are going to go on the manuscript when it's done. So, fostering more of that friendship. (Interview 5, Resident)

> This is an interesting idea, collaborating with advanced residents. I think that is something that isn't encouraged as much as maybe it should be. The reason I think it'd be a good idea is because much like we teach junior residents in the OR… it forces you to know the material better and then it also gets you to improve your teaching skills. I think that would be very beneficial from a research standpoint as well because I think it would reinforce the important concepts you've learned, and if you involve more senior residents, they might have a bit more availability and approachability when you compare it to a staff person… I kind of envision a more junior resident pairing up with a more senior resident who has a project underway, where the senior resident has a comfort level to describe how they came up with this project idea, the steps that they went through to get it underway, and what their next steps were. So they could work hand-in-hand to progressing the research project, and also learn from the steps without doing it themselves. (Interview 2, Resident)

Emphasize research achievements so people want to be involved. A suggestion to emphasize achievements in research arose from resident and faculty interviews alike.

> More emphasis on achievements within research by residents. We do have the resident research days and stuff like that, but oftentimes not a lot comes from that. People who attend there, they know what's going on, but I think a lot of departments could learn from what we're doing. If there's somebody who's interested in international research, we've got people who are well-versed in that now; if people are interested in doing animal research, we have people who do that here. So, making it more accessible for the rest of the university to take advantage of some our knowledge, I think would be something that could be useful. Not just within our department, but within the

> University some of the impressive things that are going on. I'm sure there's people in Internal Medicine who are getting published in The New England Journal [of Medicine]; why not boast about that? People who are working on Mercy Ships… let other people know about that. I think that needs to be done so that we know what's going on as a whole College of Medicine. I think that's great; I think those things should be made public. You never hear about any of that stuff... Why not tout that? (Interview 5, Resident)

> It would be nice to really highlight contributions researchers do in our day to day work, from our institution. I don't do a lot, but I know there are a lot of people who do lots of research here. It would be nice to have them showcased a bit more so it's bigger profile. So people want to do it, want to be in that environment a bit more, rather than feeling a bit disconnected from it. (Interview 7, Faculty)

In summary, establishing an alternate funding plan that includes financial compensation for academic time, encouraging interdisciplinary collaboration, fostering mentoring relationships, and emphasizing research achievements were suggested as mid-term actions to improve the research program. Long-term suggestions for improvement are described next.

Long-term Ideas for Improvement

Long-term ideas for improvement consisted of those suggestions that would require longer planning time or resources, or those which were outside the locus of control of the program and Department. They included suggestions to modify the Clinical Research Methodologies (CLR 800.3) course in which all first-year residents must partake, enhancing the statistics teaching for residents, initiating a Faculty Research 101 workshop or course, and hiring more research support staff.

Modify the introductory research course. Although residents expressed conflicted opinions about the utility of the Clinical Research Methodologies course (CLR 800), there was unanimous support for modifying it to better meet their needs. CLR 800 was described as "a royal pain... Seemed like a bunch of pointless busy work" (Interview 5, Resident). There was agreement that it is not meeting residents' need for learning about statistics and design issues.

> …A better designed curriculum for teaching research methodology and statistics. Primarily statistics. I think most people would be more comfortable with research methodology, but it's the stats that would give everybody the most trouble, and it's the area that we're the least interested in as well. And that the CLR course may not be the best way to cover that base when it comes to meeting accreditations standards. (Interview 1, Resident)

Furthermore, residents expressed the need for CLR 800 to focus on driving residents towards the completion of a viable protocol.

> Give people enough time to seek out and find a topic they're interested in. Then modify the course so that it drives you towards completion of a research project… I think the CLR 800 course can serve a purpose… I did find the certain things helpful... By the time I completed that course, I had a rough outline of my presentation… We just had to smooth out a couple rough edges and present at journal club; we were pretty much ready for submission to ethics. (Interview 5, Resident)

> I would like to see a little bit more structure in how you need to organize, or construct study protocols and designs. With maybe even, not just how to, but maybe resources that are available to residents to help them do that. So whether that be… the statistics department [the Clinical Research Support Unit], which helps us analyse and create figures… If we could have something almost in place like that, where there's a group or someone that knows how to review study designs, to help look at pitfalls before studies get started... Even in our own study, where we started something, and then started collecting data, and then found out we can't do it this way, and had to go back and restart. And I think I have seen that in a lot of residents' projects... With the limited amount of time in research we have, you can't waste time and money collecting stuff, and then have to go back to the drawing board. So, you have to have everything and all your ducks in line in terms of your study design so that you know it's going to be good quality with the data that you get, so you don't have to go back. (Interview 9, Resident)

> The CLR course could be revamped and made far more applicable and useful for residents. There's a lot of information that we get taught and given assignments on that is perhaps not useful. And then the things I feel like I would like to know, or that I would already be deficient coming from medical school into residency in would be more of your statistical analysis type questions which we get asked on our ABA [American Board of Anesthesiology] exams, as well as trying to decide what is the best way to analyze our own data in our projects. I feel like I still don't have a good grasp on doing that. (Interview 1, Resident)

Enhance statistics teaching for residents. Connected to – but somewhat separate from – the shortcomings of CLR 800 was the issue of statistical teaching. There was recognition that residents are not as strong in statistics as we would hope, but there was also a certain level of

comfort with the status quo around this issue. Suggestions for improving statistics teaching for residents included holding more frequent curriculum seminars, and emphasizing the importance of self-directed learning outside the curriculum seminars.

> I think reinforcement of these things [statistics] is very key. But how do you do a better job of it, beyond what we're doing? A lot of it just comes down to– it's on the individual person to continue up these skills... It's a lot about pushing yourself on these concepts. So yeah, I could say it'd be a good idea to have a curriculum seminar every… couple of months to reinforce these topics, but that's also unrealistic, right? Maybe another one later on, as opposed to being a full year apart, or whatever. Yeah, the cycle is two years, so that might be a bit too long before we refresh ourselves on those topics, but I think it just comes a lot down to being motivated yourself to learn these topics because it's something we're not comfortable with. (Interview 2, Resident)

> At the end of the day, there is a significant requirement for residents to have self-education outside of curriculum seminars… You can't learn it all in the curriculum seminars. But if the residents have identified that they feel that they get more value in the curriculum seminars – of foregoing something else – to have an extra session for statistics, I'd be all in support that. (Triadic Interview 8, Faculty)

Develop research skills in mentors. Several interviewees raised the idea of holding a Faculty Research 101 to produce more competent mentors.

> What about a training program for your staff, like a Research Mentorship 101?... A faculty retreat that everyone is going to come to anyway, there's other departmental stuff on the agenda, and then that's a half, 50%, of it or something… It might help your less-experienced, or newer, younger staff who just aren't really sure, though, and want to be interested… (Triadic Interview 8, Faculty)

> I would be very interested in knowing if there was a Research 101, Research for Dummies, something very specific for clinical people like me who absolutely know nothing about it, but in a supported way… where I could take a day off, and it's not a hardship for my department, it's not a hardship for us financially to do this, where we could be assisted with this. That would be a perfect way to do it. (Interview 7, Faculty)

Hire more research support. In addition to perceiving a lot of support for research, interviewees expressed a need for additional support staff such as a study nurse to help with data collection and a PhD researcher in a science related to anesthesia.

> Having somebody to do some of the paperwork for us on our research projects, such as getting the proposals done, or the ethics proposals done. (Interview 1, Resident)

> There may also be more resources as far as nurse researchers go, to help residents get the paperwork done for their projects so it's not so onerous that way. I feel that we kind of lack that extra step to help research flow for residents... (Interview 1, Resident)

> …It would be very nice to have a PhD researcher of some sort with a good CV full of publications and with extensive connections... An experienced PhD researcher in something to do with at least one of the sciences related to anesthesia, but who is also interested in teaching and mentoring the residents. So that's the ideal... (Interview 3, Faculty)

However, perspectives on this issue seemed to differ. Although residents preferred to have support staff to take over paperwork and data collection, the Research Director expressed these as expectations he held for residents.

> It's hard to separate it out, clinician research from resident research. I think our department would value tremendously from having a dedicated research – outside of your role… But if we had – for lack of a better term – a research nurse who could help facilitate data collection, I think that would be tremendously valuable. But probably more at a faculty level than a resident level, because some of my expectation of the residents is [they] do data collection themselves. (Triadic Interview 8, Faculty)

In summary, long-term ideas for improvement which required longer planning time or resources, or were outside the locus of control of the program and Department, included suggestions to modify the introductory research course, encouraging statistics learning for residents, developing research skills in mentors, and hiring more research support staff.

Research Climate and Culture

The culture is one in which research is secondary to clinical duties. Residents and faculty consistently expressed that clinical work is the first priority.

> To be blunt, the fact of the matter is most people, I think, look at it and say, 'We are here to do medicine and anesthesia. I don't want to do statistics; I don't want to learn about research methods... that's not necessarily our game. It's part of it; it has to be, with evidence-based medicine. But it's kind of like one of those things that you try to put to the bottom of the list because there are more interesting or more often relevant stuff, like the clinical science… but I think our department is trying to improve that. (Interview 5, Resident)

Despite prioritizing clinical work over research, there was a sense that our training program is superior to many others. Several interviewees expressed a belief that our research climate is better than other anesthesia training programs across Canada, and other specialty training programs in the College of Medicine.

> I think… ours is pretty good compared to other departments… We've done well at the medical school presentation days of various kinds; we've had a fair number of resident projects go on to get published in reputable journals… a number in the Canadian Anesthesia Society journal, and some in PubMed listed electronic journals. But I don't know how that compares with other departments, and I think it's quite variable department to department. (Interview 3, Faculty)

> As other departments have seen, a lot of our research days, our department is the one that's consistently providing the vast majority of resident research projects, I think, based upon what I've seen over my years. So I think we have a lot of successes. (Interview 9, Resident)

> Just reflecting upon your most recent program review, how do you think our program stacks up against other Canadian programs? [asked by the Research Director and answered by the Program Director] At the very top, for research, in terms of culture, structure. Uh, quality of research? Other people are doing well. That is not a good benchmark, in my opinion, for a program alone. That's a good benchmark for departments, possibly; so if you take the UBCs and the Torontos, they are going to have these dedicated, big-name researchers carrying on pretty high quality research and the residents get tacked on. But in terms of volume, and if you need a middle level, of what the lowest common denominator does in any program, then our program is doing very well. (Triadic Interview 8, Faculty)

Interviewees recognized that there was a lot of support from the Program Director and the Department for resident research. However, they also commented that a culture change would be required to foster a more research-intensive environment.

> I've found the climate has been extremely good – better than I thought, with skilled research assistance to help guide us and a very keen resident, and assistance with another institution that we're working with. (Interview 7, Faculty)

> If we were more salaried, for example, which is a whole different kettle of fish… and then one day, instead of coming into work, we would go to this and be better at that [research]. I think that would be a great way to do that. But that's not the culture here. The culture is we are fee for service and we work cases, and the non-clinical work isn't well-supported in the health region and University, I don't think. And again, maybe there are resources I'm not aware of, but I certainly know there's a big push for clinical

> work, so if I do take a day off to do that, then clinical work isn't getting done and that's of primary importance for our region. (Interview 7, Faculty)

One interviewee emphasized that the structure of the Department contributes to shaping a culture that supports research.

> The structure of the research program itself is very much the reason why the culture was easier to establish and why research actually takes place. Research is a pain to do, there's no question about that, and not everybody wants to do it – in fact, the vast majority of people don't ever want to do it. But what we did initially was to establish it as a mandatory component of our training program… Just establishing it doesn't make it happen; people make it happen. [The former Research Director] certainly started it. I think [the current Research Director] is giving himself less credit than he's due, [the current Research Directors] and other people who got involved, certainly created a visible persona for the research people in the department. That, coupled with the mandatory component and the research peoples' availability, and certainly [the Research Coordinator's] availability. Every successful program that I have been able to see that is conducting research in Canada… they have somebody who facilitates it at a nuts and bolts level. Without that, it doesn't work. So I think having a mandatory component as an integral structure really helps, then everybody buys in. Automatically, the culture changes even if it wasn't conducive in the beginning. (Triadic Interview 8, Faculty)

Role models are important, and visible personas for research encourage others to become involved.

> I think the other strengths of our program, we have [the former director of research], who has been very passionate about research for many years, and… I think that he was very much a role model for many in terms of his dedication to the program, and I think that he established a lot in terms of some of the culture that currently exists for research here… His personal dedication to research was admirable. He, at one point, I think, supervised all the resident research projects; he carries on numerous projects by himself, he always has time for people and their questions; he's quite knowledgeable in terms of statistical design, research history, and he spends every Sunday, when he's not working, in his office doing research, just 'cause he likes it… It was certainly admirable to see him to do that… He's been a constant advocate for our department's research efforts. (Triadic Interview 8, Faculty)

On the other hand, witnessing the struggles of others may detract from research involvement.

> We are non-heavily research-driven department… There's a big push for the clinical; there's so much clinical work to be done, and it's well remunerated. I do my research on my spare time; I don't do research in any academic time that I have, really. I have a

> little snippet of academic time given to me for a lot of things I do, but all my research I do is in my spare time. And so residents who see that are not likely to look at research as a fulfilling and well-remunerated- And we tend to look at it saying we need money, and respect maybe go together. It may not be considered highly respected to go on and do a research career when you aren't going to get paid very well for it, there's not a lot of other rewards for it. And when doing research is your hobby, it doesn't necessarily look like something you want to do a lot of. (Interview 7, Faculty)

A Decision on Actions for Improvement

The second research question for this study was "When afforded the opportunity to collaborate in improvement of the resident research program, what three interventions will be proposed by residents and faculty to achieve the ideal resident research training environment?" We began to answer this question after my presentation of Phase 1 (quantitative) and Phase 2 (qualitative) results of the research at the Anesthesia Journal Club on April 17, 2014. However, additional improvements were initiated in the following months. All decisions for improvement and initiated actions are described below.

Following my presentation at the Anesthesia Journal Club on April 17, 2014, there was a brief discussion of actions that could be implemented. When the conversation was slow to get started, the Research Director deferred to me ("Since you have been working most closely with this, you are probably the best-positioned to make recommendations. What would you suggest we do?").

Six interventions were discussed, based on the ideas I presented. These are outlined below. The chosen actions for research that provide easily-achievable short-term goals include:

1. Ask senior residents and faculty to attend the Research Orientation for first-year residents on July 11th to enhance communication of ongoing and new research ideas, and provide earlier exposure to faculty;
2. Create a research section on our SharePoint site for enhanced communication of research ideas, and to offer examples of previous study protocols and ethics applications;
3. Encourage resident collaboration: by stating at the Research Orientation on July 11th that "we encourage you to work together," by offering a range of options such as individual projects, new team projects, and joining ongoing projects, and by drafting an agreement for accountability of all collaborators.

The other items that were discussed, would be long-term actions, were:

- To hold a research mentoring Grand Rounds 3-4 times/year, where faculty could briefly talk about their research interests and current projects.
- To require that faculty submit one quality assurance idea as part of their review for promotions.
- To hold a formal retreat to share ongoing research, but also to brainstorm the research direction for the department – what should we pursue as a department? The goal would be that faculty would set the direction, and residents would get "swept up."

Concluding Thoughts

In this chapter, I have summarized the results of the semi-structured interviews which were conducted to explore the underlying reasons for identified shortcomings, and to generate ideas for solutions to guide three simultaneous action research cycles. I concluded by describing the priorities for action that were collaboratively set by residents and faculty. In Chapter 6, I will describe the implementation of these actions and present the results of the follow-up semi-structured interviews that I conducted to investigate resident and faculty perceptions of the impact of these actions.

CHAPTER 6

FOLLOW-UP INTERVIEW RESULTS

Following the implementation of actions for improvement, action research includes provision for reflecting upon the results of the actions (Kemmis & McTaggart, 1988) or looking and thinking again (Stringer, 2014). Lewin proposed "a circle of planning, action and fact-finding about the result of the action" as a method of undertaking action research (1946, p. 38). To this end, I conducted a second round of semi-structured interviews to gather resident and faculty perceptions about the impact of three collaboratively chosen actions for improvement.

The results chapters are laid out temporally. In the previous chapter, I described the priorities for action that were collaboratively set by residents and faculty. In Chapter 6, I will present the results of the semi-structured interviews that were conducted to follow up on resident and faculty perceptions about the impact of these actions.

Phase 3: Follow-Up Interviews

The results of the follow-up interviews with residents and faculty are presented in the following pages. I describe the participants, then describe their reactions to the changes resulting from implementation of the actions for improvement.

Participants

After implementation of three actions for improvement, I circulated an invitation to junior residents and faculty mentors on July 22, 2014, soliciting their participation in the follow-up semi-structured interviews. Following written informed consent or verbal re-confirmation of previous written consent, eight residents and three research mentors were interviewed between July 25 and August 15, 2014. As depicted in Table 4, resident-participants represented mostly junior years of training, since the actions were directed toward the early years of residency: all

six R1s, one R2, and one R4 who participated in the implementation of the first action for improvement. Six were male (75%) and two were female (25%), approximating the proportion of each gender in the residency program in 2014-2015: 26 males (81%) and 6 females (19%). The majority of participants had previous research experience prior to entering the residency program, with three participants having completed at least one Dean's Summer Student project during medical school, two participants having a prior graduate degree, and one participant having worked as a researcher for over 10 years. Only two resident participants did not have any prior research experience.

Table 4

Resident Participants in Semi-Structured Interviews, Round 2

Characteristic		*n*
Year of training	R1	6
	R2	1
	R3	0
	R4	1
	R5	0
Gender	Male	6
	Female	2
Prior research experience	None	2
	Dean's summer project	3
	Graduate degree	2
	Professional researcher	1

The three participating faculty mentors were pivotal decision-makers in the development of the resident research program, including the Research Director, former Research Director, and Program Director, and had participated in the first round of interviews. All three were male (100%) and none were female (0%).

General Reactions to the Actions for Improvement

Overall, faculty and residents expressed positive reactions to the actions for improvement. They felt that the changes were positive for residents in the program. However, there was some doubt on the behalf of faculty about our ability to see concrete results so soon. Three concurrent action research cycles are outlined in Table 5, including the actions chosen to improve the resident research program, the corresponding implementation dates, and feedback gathered during follow up interviews.

Table 5

Three Concurrent Action Research Cycles

Think	Act	Reflect
Need to enhance communication of new and ongoing research ideas and provide earlier exposure to faculty	Faculty and a senior resident attended the Research Orientation for R1s on July 11, 2014.	• helpful for both residents and faculty • presentation by a senior resident was the most useful to new trainees • discussion generated several ideas for future improvement of the orientation
Need for enhanced communication of research ideas, and to offer examples of previous study protocols and ethics applications	Created a research SharePoint site, launched on July 11, 2014.	• residents appreciated knowing where they could find resources as the need arose • faculty and residents offered suggestions for further material that should be added
Desire to encourage resident collaboration	Stated at the Research Orientation on July 11, 2014 that "we encourage you to work together," and offered a range of options such as individual projects, new team projects, and joining ongoing projects.	• residents expressed reservations about the logistics of collaborating with other residents, both in starting new projects and joining ongoing research projects • faculty expressed some hesitation to residents working together, and requested clear expectations for collaborative efforts

Action #1: Early Exposure to Faculty at the Research Orientation

The first action for improvement was to ask senior residents and faculty to attend the Research Orientation for first-year residents on July 11th to enhance communication of ongoing and new research ideas, and provide earlier exposure to faculty. They were invited to speak briefly about their research interests, and any projects in particular that would benefit from involvement of junior residents. All interviewees felt that this was a useful exercise, but residents tended to think that the presentation by a senior resident was more helpful than those of faculty mentors. In addition, there were several suggestions made for continued improvement of this initiative.

Useful to both residents and faculty. Interviewees commented that the research presentation portion of the orientation was helpful to both residents and faculty because the face-to-face contact initiated a feeling of comfort with faculty mentors, gave new residents a sense of what sort of research happens in the program, and, for faculty, provided a forum to share their research ideas.

> It was good to put a face to people and get an initial sense of what the environment is like here, in terms of what support you have and all of that. (Interview 4, Resident)

> I thought that it was a good way to… put a face to the names of the projects, and sort of get a sense of what each individual person, and what their realms of expertise are… Just so I could get a sense of what my pre-established interests were and sort of be able to identify …who should I consider talking to if I were interested in that realm. It was a lot more helpful than sort of having names floating around. Yeah, I thought it was good, much better than having a list." (Interview 4, Resident)

> …I thought it likely would be beneficial, and it was beneficial for me to get the information out there as a faculty researcher… (Interview 3, Faculty)

> …As far as having [research mentors] there, I think it's good just to give people a bit of an introduction as to what they can expect in terms of different types of projects they can do and the different personalities to work with and all that kind of stuff. I think it almost demystifies it a little bit. So I think that was pretty valuable, I think it was a good thing, and I think that should be commonplace within the department for all incoming residents. …By having [faculty researchers] and anyone else who's involved

> in research…, to have those people come in and say hello, to put a face to the name, and get the new residents acclimated to those people who are more heavily involved with research also helps, so they're not just approaching someone they've never seen before and only heard of… and nice to get a little face-to-face time. (Interview 6, Resident)

Hearing from a senior resident was "the most useful and engaging". (Group Interview 1, Residents). Although most residents thought it was useful to hear from faculty mentors, they felt that the presentation from the senior resident about his experience completing a project was the most useful.

> I find even with the list it's hard because you read all these things and you don't really know what interests you… the faculty was great to meet them and get them to talk about it, but, listening to [the senior resident's] presentation, the most useful thing I took away from that was how he went through that process of finding something interesting and how he sort of came about doing that was quite useful, especially at this early stage. I mean, we have that list and it's great, but for me, I don't know what I'm interested in, really, and just randomly pick something and go with it? I don't know… (Group Interview 1, Residents)

> … It's always nice to have somebody who is not just involved with research from a faculty side, but I think, from a residents' side. I think that's pretty useful for the new residents who are just kind of starting up, while maybe they're in their early phases of developing their project, just to kind of hear that it's maybe not as onerous or as intimidating as they might perceive it to be. 'Cause I know when I went through, there was all this talk about "oh, you have to do research, and you have to come up with a project, and then you have to have it go through all these different steps of being approved by ethics, and all that kind of stuff." It's kind of intimidating; you're just like "Holy, this is a lot more work than I expected." So I think it was pretty valuable, and the little bit of feedback I got from the junior residents, they found it to be fairly positive, I believe. (Interview 6, Resident).

> I think it was really good. I think entering a postgraduate resident training course is stressful, and I think that there's huge expectations of time of the residents, both clinically and then to put a research expectation on top of that is difficult. But to talk to some of the residents who have done it before, I think that's valuable for people to see that it's doable. There's a lot of fear of unknown and people ending up in any professional program, most people have a strong fear of failure. So I think it's good to put some faces to some people who have actually… oh, I do, absolutely [think it helps to mitigate that fear of failure]. Like, you know, everyone sees the world differently, but if you know someone else can do it, lots of other people can do it, …not just the nebulous someone can do it, but this person can do it… (Interview 5, Faculty)

Ideas for continuing improvement. Based on their experience with the inclusion of resident and faculty presentations at the research orientation this year, interviewees made several suggestions for continuing to refine and improve content in the future. These included the addition of resident presentations from members of each year of training, asking faculty to focus on one or two specific projects, and including resident presentations from those using a variety of methodologies.

> I think it would have been nice to have residents in different years 'cause then you really could have seen how people go through the process... So have R2, R3, R4, ideally an R5 that's completed a project... Then it could have been nice to see how ideas are developed. … and then, too, in the fifth years, to see some of the challenges that they've faced in their research, to sort of try to understand where they maybe run into more challenges so that we can, at an earlier stage, try to trouble shoot things that we run into." (Group Interview 1, Residents)

> I think what may have been a little bit more helpful would maybe to sort of focus on specific projects of interest, just to get an idea of what the realm of interest is, rather than necessarily going through all the projects that they were interested in. So, maybe picking 2 or 3 key ones probably could have been more effective. (Interview 4, Resident).

> It might help to have someone like [a resident doing survey research] or someone like that that's got a different type of research, just because they're just conducted so differently. So that might show them what different things are available, because they might be thinking it's got to be purely science, purely bench, that kind of thing. (Interview 7, Resident)

In addition, faculty interviewees would like to see more mentors speak at the next research orientation.

> I wish there could have been more faculty participating there, so perhaps we can do better next year." (Interview 3, Faculty)

> It's always difficult to arrange these things, but obviously the faculty who are doing research should try and be there. And that isn't a lot of us. (Interview 2, Faculty)

The inclusion of resident and mentor research presentations at the Research Orientation was helpful for both residents and faculty researchers, although the presentation by a senior

resident seemed to be the most useful to new trainees, and the ensuing discussion generated several ideas for future improvement of the orientation.

Action #2: Shared Online Resources

The second action undertaken for improvement was the creation of a research section on our resident SharePoint site for enhanced communication of research ideas, and to offer examples of previous study protocols and ethics applications. This site was populated on June 25th, 2014 with the examples of study-related documents for a sample of active research projects, a list of research ideas proposed by faculty mentors, a description of the process for requesting research time and research funds, ethics application templates, and a curriculum seminar PowerPoint presentation on statistics. The site was introduced to residents at the Research Orientation on July 11, 2014. The residents voiced an appreciation for knowing where they could find resources as the need arose, and both faculty and resident interviewees offered suggestions for further material that should be added.

You know where to look. Upon follow up, five out of six first year residents had accessed the SharePoint site for the list of research ideas, although one resident stated they "haven't perused it in great detail" (Group Interview 1, Residents). The first year resident who had not yet accessed it anticipated finding it useful when the need for the resources arose.

> It's nice to know that if you have a question, you know where to look…I think it's good that we were introduced to that early on, in terms of 'this is where all the stuff you may want to look for is; this is where, if you have questions about research, questions about what people are doing, you can go there. And it was presented early. It gets us thinking about it, even if we are struggling in other areas, trying to organize ourselves. I think it's important the seed was planted early." (Group Interview 1, Residents)

> No. I'm sorry… I'm new to the city, I'm new to the program, I'm settling myself in, sort of understanding where to do other things and it's not really a priority on my list, unfortunately, at the moment. I have no doubt that it will be an essential resource once I go through that... course we have to take… but just in terms of priorities and relevancy at this current moment, not quite yet. (Interview 4, Resident)

Faculty suggestions. No faculty interviewees had accessed the research SharePoint site, although they agreed that "it sounds like a very good idea" (Interview 2, Faculty) and offered suggestions of what resources ought to be available on it.

> Since I haven't looked at it myself, I may be repeating information that's already out there. But what I think would be very useful is exactly what we discussed in the first point, to know which researchers are involved with what kinds of research, what the interesting topics are, as well as the ongoing research projects. So, a list of all those needs to be there and I'm reasonably sure it already is… Might be useful to have that list, and separately have examples of well-written protocols and other things that can be ameliorated. (Interview 3, Faculty)

> Do you have the previous resident abstracts from Bev Leech?... Do you have different links… like, the link to Guyatt's textbook of studies of clinical epidemiology [User's Guide to the Medical Literature: A Manual for Evidence Based Clinical Practice]? That's pretty valuable. There's a bunch of online statistical calculators, statistical help pages, just some other links would be great… I think it's good. Having like an online, centralized online repository of research information tools is great …and specifically geared towards what their expectations are going to be. I think it's really well-placed. (Interview 5, Faculty)

Resident suggestions. Residents also offered suggestions for additional resources that would be helpful if available through the SharePoint site, including consensus guidelines for reporting various types of research and a link to *The research guide: a primer for residents, other healthcare trainees, and practitioners* (Harvey, Lang, & Frank, 2011).

> I think [a resident] had a good suggestion at that meeting, to put things like the consensus guidelines, or that kind of thing, so it's just easily accessible, 'cause that'll be helpful for both first and second years towards their project. (Interview 7, resident)

> … I forget what the name of that one book was that you referenced me for my Journal Club, where it talks about the different types of studies, and the different biases...[The research guide: a primer for residents, other health care trainees, and practitioners]. I'm sure you have links to that, or there's somewhere on there that you have that available. I found that very helpful for Journal Club, and analyzing a research study. But it would also be useful too in the reverse, in helping you build one up and then take into consideration all the different variables and the different biases with the different type of research study design that you're going forward with. (Interview 6, Resident)

Most new residents had accessed the research SharePoint site to peruse research ideas, and interviewees agreed that it was helpful to know where they could access this online

collection of resources as they became necessary. In addition, both residents and faculty offered several useful suggestions for further resources that could be added to this site.

Action #3: Encourage resident collaboration

The third action that was agreed upon to improve the program was to encourage resident collaboration by stating at the Research Orientation on July 11th that "we encourage you to work together," by offering a range of options such as individual projects, new team projects, and joining ongoing projects. Follow up interviews highlighted resident reservations about the logistics of collaborating with other residents, both in starting new projects and joining ongoing research projects. Follow up interviews also highlighted faculty opinions about residents working together.

Logistical reservations. Despite agreeing with the idea of collaboration in principle, residents expressed uncertainty about the logistical feasibility of such an undertaking. First year residents were uncertain whether they would want to join an ongoing project because they feared lacking interest and ownership over the idea.

> Logistically, I'm just wondering how it would work… 'cause we're all sort of on different rotations, and yeah, that would be my only hesitation, is just how to do it logistically. I think it's a great idea. I think it makes a lot of sense and that's how research is done in the real world. You never have one person doing everything; there's a list of authors. I guess it's just trying to figure out how to do it in an actual residency program. (Group Interview 1, Residents)

> Personally, I'd be less inspired; it'd be nice to do something from the ground up, 'cause I feel that maybe that's part of the point of us going through a research project, to go through the process of starting from the beginning and ideally taking it to the end… ideally it'd be nice to go through that process in its entirety… …Interest plays a big role… if you just jump on board out of necessity, you might not necessarily have interest. You're just trying to get the job done, which would definitely impact the efficiency of the project… It all depends on whether I get to take ownership of my role [lots of nodding in agreement]. Maybe you don't necessarily want to jump on board because you recognize barriers to completion of the research… it makes you wonder why it's not working. (Group Interview 1, Residents)

However, one first year resident offered a different perspective, when she answered that she'd prefer to join an ongoing project because most of the groundwork would already be done and she preferred to work within an established structure.

> I could [join an established project]. The honest answer of… why is, in my experience, it's easier. There's a pre-established protocol and there are established goals, which I personally find easier to manage, by having a foundation already, rather than trying to sift through ethics, and …spending that extra year to establish those things. Most particularly in a new province where some things may be a little bit different. I don't know how; I haven't really looked into it. It's always nice to have that support already in place; I find that easier. (Interview 4, Resident)

Resident interviewees proposed ways to collaborate that would still allow them to maintain ownership over their own research projects, but they could help each other out with recruitment and data collection.

> I could see how it would be applicable in an upper-year to lower-year thing, like someone's leaving the department and handing off a project to someone else… But sort of collaborating amongst us, it'd be great, I think, and the make things like data collection and writing up and stuff easier, but it'd be tough to sort out who becomes first author, who does the bulk of it, who directs it… What I do envision happening is that we'd all have our main projects and we'd help each other on our other projects. And that seems much more feasible to me. Like, you'd have something that you're working on, and then say 'oh, I'm not in town this month but I need my data collected' and [another resident]'s on anesthesia and she could help me hand out surveys or something. Things like that seem more reasonable to me." (Group Interview 1, Residents)

> …It might be good for people who are doing existing projects, ...either on the SharePoint, just say whether help could be required if there's interest, or if… some of the fourth or fifth years want to pass on a project that needs completion, or another phase, just so that the first years sort of know, just think in adding to what they know is available. (Interview 7, Resident)

Faculty opinions about residents working in teams. Faculty expressed some hesitation to the idea of residents collaborating on research projects, and cautioned that the research team would need to set clear expectations on what would be sanctioned as collaborative efforts.

> …There are certainly clear examples out there of residents collaborating on an individual project. My concern is that if residents view that as a norm, they may double up on projects that don't really require two resident researchers. So we will have to be very careful about, as a research team and mentors, as to what we sanction as

> appropriate collaborative efforts… So an easy one [an appropriate team project] is a longitudinal project that can't be completed in the timeframe allocated for one resident. And the more difficult one would be a project that, in its breadth, certainly could use two resident researchers involved, but then that would have to be adjudicated on a case by case basis. I think the research team probably should probably get more involved when such a desire is brought to light, and if the breadth of the project and the work involved merits two residents, then probably it's appropriate. And to a certain extent it would also depend upon the residents who are actually involved. Certain residents are very gung ho about carrying on projects, others are not. So if somebody is tail-coating, it comes to light. (Interview 3, Faculty)

> Mixed thoughts about it, to be honest with you. I think it's good to work together, like [two fifth year residents] worked well together, for example, and I have no doubt that [two second year residents] are going to work well together. Those are two highly-motivated individuals who… they themselves are a strong research team, no matter how you would stack them up, right? But, you know, there's a lot of value in conducting a research project, beginning to end, by yourself, as opposed to the inevitable delegation of duties that are going to happen in the process. It just helps people understand the process and some of the limitations. So, no matter what you do, I think one of the tenets to be a good doctor is to be able to actually read and interpret what's being said to you. And some of the comments of limitations of study design are real, but I think sometimes it's important to understand what the limitations of research are. So I think the experience might be a little bit diluted… but maybe if it's systemic, it's not going to be. (Interview 5, Faculty)

> It's hard too, right? Like, you join something that's already in progress, you don't have to do the background literature search, the protocol development, the ethics application. I think there's lots of negative towards that. In my mind, in some respects, that circumvents the whole purpose of doing… The way I see it, the purpose is not just to generate research, generate knowledge; it's the understanding of the process and then the generation of knowledge is a bonus. I'd actually like to see some of the ones who join something new, that they'd still have to complete a project. (Interview 5, Faculty)

Follow up interviews highlighted resident reservations about collaborating with other residents, both in starting new projects and joining ongoing research projects. Most resident interviewees indicated a preference for starting their own project to working in teams or joining an ongoing project because they believed it would offer a more interesting opportunity for which they could feel a sense of ownership. However, they did propose a way to help each other with data collection while still maintaining autonomy over their own research. Follow up interviews

also highlighted faculty reservations about residents working together, and suggested further work is required by the research team to define the parameters of resident collaborations.

Action Research and the Research Climate

A secondary objective of this study was to discover what action research, as a dialectical process of co-generating solutions to practical challenges, could offer to our understanding of research training in residency. Residents and faculty described their perceptions of the research climate. Furthermore, they were asked to comment on the extent to which this research project was able to achieve collaborative decision making and to solve the problems of practice that were identified in the research climate.

Research Climate

Interviewees were asked to comment on their perception of the research training climate. They expressed the belief that this action research was successful in fostering an improved research training climate in the program.

> Definitely… I think definitely, because coming into a department, you don't really know how much support there will be for research… Having this [action research] going on makes me feel like there's… a good support, and an interest in cultivating our ideas and our research, without too much pressure to produce something. That definitely feels quite nice. (Group Interview 1, Residents)

> Well, yeah. I do think it's getting better and better. And the orientation has been improved by these measures… they're getting more information and clearer information. (Interview 2, Faculty)

> …If you do feel like your product is valued, I think you're going to work harder at it... If it's not just a tick box that you have to complete, it's like, 'no, this is something I want to do a good job at because everybody else is working hard… This is something that we want to do, this is something that we want to do well, and if everybody else is doing well, I think it's easier to generate that energy, that passion behind it." (Group Interview 1, Residents)

However, there was some lingering doubt as to whether these changes were attributable to this action research, or another mechanism.

> I think I'm just unsure, 'cause I know in this program it's been more of an emphasis, and so research has always been more talked about than other programs. And I think that sort of started last year anyway, so it's hard to tell if that's been improved, at least at my level. (Interview 7, Resident)

The changes to the research climate were attributed in part to the reflexive nature of action research.

> It has [affected the research training environment] to a certain extent, in that you're getting people from all different levels – senior staff, junior staff, senior residents, junior residents – talking about research a little bit more. So it's not just research projects, but the culture of research within the department. So, I think actually talking about what we do, how we do it, what can be changed, why things should be changed, things like that, that actually gets people thinking about research as a whole and as a discipline rather than just this abstract thing that everybody has to find a project and do it. I think it's a good reflective exercise, everyone within the department. I think it has changed because it's forced us to look at what are we doing, what can we be doing better, and how can we do it better. So I think it has. (Interview 6, Resident)

Furthermore, interviewees expressed support for the idea of beginning the improvement of our research culture with residents.

> I think with trying to develop a culture, we kind of have the faculty and then you have the residents. For the residents, we're probably more malleable, less stubborn. If you encourage us to approach faculty, then they get kind of an established research base, and then in future years they're maybe more interested or more comfortable with research, and then it'll snowball on itself. So I think that's a good way to do it. Instead of having someone like [the Research Coordinator] hounding faculty, saying 'you have to do more research; you have to do more research.' If you present it to the residents, the residents will present it to the faculty. Then in subsequent years, you kind of develop that global culture… Yeah, if you get the residents involved right now, we'll probably make up a proportion of the faculty at the U of S, so it kind of changes the faculty's culture over time. Having it as part of our curriculum through the years, it sort of normalizes it. This is the expectation that all of us are going to be involved in research in some capacity. So in developing a culture, you've sort of already normalized it, like this is part of what we are expected to do in the future, and we'll be much more willing to take on people or help them with their stuff that comes up and continue to say that it's normalized. (Group Interview 1, Residents)

Most interviewees believed that this action research was successful in fostering an improved research training climate in the program, despite some reservations from faculty that it

is too soon to measure any difference. The reflexive nature of action research was credited with some of the changes in the research climate.

Collaborative Decision Making

The participatory element of action research "affirms people's right and ability to have a say in decisions which affect them" (Reason & Bradbury, 2006, p. 10). For this reason, interviewees were asked to comment on whether they felt this action research was able to achieve collaborative decision making, and that made them feel like their opinions were valued. Residents expressed appreciation for the opportunity to give feedback, as it made them feel like the research training they receive is a "malleable process" (Group Interview 1, Residents), attentive to those who are impacted by it. Faculty interviewees recognized that a large group of department members were able to give input into the process, although one faculty mentor suggested that we continue to strive for involvement from faculty in Regina.

> It shows that people can have an impact on how research is run in the department… It gives us the sense that it's a malleable process that we can give feedback towards. And I think that's an important thing; it's a good thing. Even through medical school, the good programs or structures that we had in place were the ones that were built through getting feedback from the people that it directly impacted, and in this case it'd be us, because we're the ones who are going through this research process, right? And it'll be the next year's first years will be going through what we're going through now. So getting feedback from the people that it impacts directly, I think is super important… It made me feel like these ideas are valued, too… So, the questions that we generate are valued, the input that we give is valued, and assumingly the projects that we develop and create are going to be valued, right? I think it's a good way to do it. (Group Interview 1, Residents)

> Oh, gosh, oh yeah, absolutely. I think that was fantastic. It was great to have this presented at Journal Club and getting input from a large body of faculty in our department. Not everyone was there, of course, but in reality, the people that are interested are going, and the people who are likely going to be playing roles in that are the ones that are there. I don't think people's input was limited by time. Different personalities are different, right? Some people are going to speak up, some people won't. (Interview 5, Faculty)

> It's tough for me to say, because… I'm not in a position where I get to make a lot of decisions that impact research. I think at the very least, those [R-RTES] surveys you

> got us to fill out… By doing those surveys, we all were... forced to take a look at the research climate and the research dynamic as a whole within the department... But at the very least, your research project and the questionnaires and the interviews have allowed people to reflect on how things are within the department, and really give it some thought… as to what could change and how things should maybe be working… (Interview 6, Resident)

One faculty member commented that we ought to collaborate more with faculty members in Regina.

> I guess if I have a concern, my concern is one that we are addressing, and that's working to some degree, and that is to involve Regina more, and maybe start to involve Prince Albert… in the resident research. They may have some thoughts about how that's possible [collaborating to improve the research training]. So both: suggestions about the research process, and also actually being research mentors and so on. And that's happening a little bit more than it used to. (Interview 2, Faculty)

The opportunity to gather feedback from a large body of faculty mentors and affected residents was recognized by interviewees. One faculty member highlighted the opportunity to increase involvement by faculty mentors located in Regina.

Solving Problems of Practice

The main purpose of action research is to solve a local problem of practice (Herr & Anderson, 2005). Interviewees were asked whether they thought this action research had contributed to solving problems of practice. Residents were more likely to see the value in action research for solving the persistent challenges in research training. However, faculty were more cautious about drawing conclusions, which seemed to be due to paradigmatic orientations to what constitutes evidence

> Yeah, absolutely, because just in your three action points, already those thing have been addressed in the orientation that was given to the first years. So yeah, for sure. (Interview 7, Resident)

> …whether the specific action points have made a difference… I'd like to think they have; they seem to have face validity but it's hard to know, right? Ask me in a year… Would you expect like, since end of June until now, to see a difference? … Just trying to think of how you'd measure the outcome. (Interview 5, Faculty)

However, one faculty member began by responding that it was "too early to tell," but, as he talked it through, finished with the realization that some challenges have been overcome.

> Too early to tell. Has it contributed? Your question is a very concrete one. As of now, I can't think of an initiative that concretely has resulted from this attempted action research. I can envision things that may impact for the relatively near-term future... Such as interdisciplinary collaboration, that I mentioned before. Well, maybe I should go back and say that one item that has changed in the research climate, a very practical one, is that participation by faculty mentors in the orientation session. So perhaps that's a very useful initiative that we will carry forward. I think it is. Having the residents exposed on an immediate face to face basis with people doing research in the department and the different projects certainly can be very useful. It's a worthwhile effort continuing in the future, so yes it has. I stand corrected. (Interview 3, Faculty)

Residents and faculty described their perceptions of the research climate. All interviewees agreed that this action research was able to achieve collaborative decision making. There were some differences of opinion as to whether this action research was able to solve the problems of practice that were identified in the research climate, which may be attributable to epistemological beliefs about what constitutes evidence.

Concluding Thoughts

In this chapter, I have summarized the results of the semi-structured follow up interviews which were conducted to explore the impact of three simultaneous action research cycles. I concluded by describing the impact of action research on the research climate, collaborative decision making, and its ability to contribute to solving identified problems of practice. In Chapter 7, I will discuss the key findings of this action research study, with implications for theory and practice.

CHAPTER 7

DISCUSSION, CONCLUSIONS, AND FUTURE DIRECTIONS

The purpose of this action research study was to understand the research training climate in anesthesiology at the University of Saskatchewan, and to collaboratively determine strategies for addressing persistent challenges to resident research training. A three-phase, sequential mixed methods design was employed to answer the following research questions: 1) What shortcomings in the research training climate will be identified by residents and faculty in anesthesiology at the University of Saskatchewan? 2) When afforded the opportunity to collaborate in improvement of the resident research program, what three interventions will be proposed by residents and faculty to achieve the ideal resident research training environment? 3) What can action research, as a dialectical process of co-generating solutions to practical challenges, offer to our understanding of research training in residency? and 4) What we can learn about the research culture of this post-graduate training program in anesthesiology?

In this final chapter, I review the background rationale that inspired this study and briefly describe the methodological approach before highlighting the main findings. Throughout, I position the main findings within the existing literature. Most notably, I offer a model for using action research to improve resident research training before returning to the conceptualization of research culture presented in Chapter 2 to refine it based on findings from the current study. Finally, I highlight the main contributions to theory and practice, and offer directions for future research.

Background Rationale

Postgraduate medical training often includes a research component to develop physician-scientists who will investigate clinical problems and bridge the knowledge-to-practice gap.

Investigations into resident research training have demonstrated increased knowledge and skills of trainees (Lowe et al., 2007; Oxnard et al., 2009, Rydman et al., 1994), but this is conditional on the research training being done well (Aslam et al., 2004; Butt & Khan, 2008; Cronk et al., 2005; Kenton & Brubaker, 2007). Resistance from residents and faculty, and lack of time, experienced mentors and support staff continue to be cited as the main barriers to resident research (Hebert et al., 2003; Seehusen & Weaver, 2009). In addition, discrepancies between resident and faculty perceptions of these challenges have been identified (Buschbacher & Braddom, 1995; Silcox et al., 2006), confusing the issue of where to focus improvement efforts.

Studies of resident research training tend to approach the issue in one of three ways. First, those oriented in a post-positivist tradition have demonstrated the factors of resident research training that contribute to productivity (Karras et al., 2006). Second, those more oriented in constructivist theory have investigated resident, faculty, and clinician perceptions of resident research training (Buschbacher & Braddom, 1995; Spice et al., 2011). Finally, those with a pragmatic orientation have approached resident research training using improvement models (Kanna et al. 2006) or evaluation and modification (Spice et al., 2011). Rothberg et al. (2014) implemented a resident research program in a stepwise fashion, specifically designed to overcome barriers to resident research that had been identified in the literature and through program participants' experiences, while Tulinius et al. (2012) strove to increase the academic capacity in family medicine through collaborative development of a training program. However, collaborative improvement of a relatively developed resident research program has not been described. This study was guided by the belief that collaborative engagement by resident trainees and faculty mentors might result in improvement of the existing research program, and

enhancement of the residency program's research climate and scholarly culture. The roles of organizational climate and culture in resident research programs have not been well described.

In action research, the researcher is oriented as an insider within a particular practice setting (Herr & Anderson, 2005). Action research is characterized by its emergent design, reflective practice, practical application, and researcher positioning as a practitioner in the setting to be studied. In 2007, the Department of Anesthesiology at the University of Saskatchewan introduced a structured Resident Research Program and contracted me as a research coordinator to supervise and assist in all phases of the resident research training under the supervision of the Research Director. An action research approach offered some promise for addressing the persistent challenges of resident research training that I had been experiencing in my professional work as the Research Coordinator in the Department of Anesthesiology because it legitimizes the pursuit of recommendations from the residents and faculty mentors that are subjected to the research requirements, while drawing upon research evidence for guidance. To establish process validity, I intended to frame the problem in a way that promoted ongoing learning and triangulate findings with resident and faculty perspectives (Anderson & Herr, 1999). In action research, the researcher is an active participant in problem solving (Greenwood & Levin, 2007).

Whilst there have been a number of published research training programs, influence over the priorities has tended to be top-down. Medical educators lack a model for collaboratively enhancing the scholarly environment for trainees in anesthesiology.

Methods

This action research study was approached within a pragmatic paradigm (Greenwood & Levin, 2007; Tashakkori & Teddlie, 2003), using both qualitative and quantitative data. A three-stage sequential mixed methods design was applied to three simultaneous action research cycles.

In the quantitative phase, 30 residents across five years of postgraduate training in anesthesiology completed the revised Research Training Environment Scale (R-RTES) (Gelso et al., 1996) as part of a program evaluation of the research training program in anesthesiology. The R-RTES comprised fifty-four items and measured the research training environment in anesthesiology on nine subscales: 1) faculty modeling of appropriate scientific behavior, 2) positive reinforcement of scholarly activities, 3) early, minimally threatening research involvement, 4) teaching relevant statistics and the logic of design, 5) teaching students to look inward for research ideas, 6) science as a partly social experience, 7) emphasizing that all studies are flawed and limited, 8) focus on varied investigative styles, and 9) wedding of science and clinical practice. Quantitative data from the R-RTES were analyzed by summing the six items within each subscale and by calculating mean subscale scores to identify areas of perceived shortcomings. Mean scores for individual items were also calculated to identify specific shortcomings within each subscale.

The qualitative phase followed analysis of the R-RTES results. Ten residents and six faculty mentors participated in semi-structured interviews and focus groups of 2-5 participants, to explore the underlying reasons for identified shortcomings, and to generate ideas for solutions to guide three simultaneous action research cycles. Qualitative data from recorded interviews and focus groups were analyzed according to the reflexive and iterative process described by Halcomb and Davidson (2006). This process involved: 1) audio recording of interviews and

concurrent note taking, 2) reflective journaling immediately post-interview, 3) listening to the audio recording and amending/revising field notes and observations, 4) preliminary content analysis, 5) secondary content analysis, and 6) thematic review. An advisory group of 22 residents and 10 faculty reviewed findings from interviews and focus groups at a departmental Journal Club, and collaboratively decided upon actions for improvement of the research training program. The third phase followed the initiation of three collectively chosen action research cycles to reflexively evaluate the impact of these actions following their implementation.

A theory of organizational culture (Schein, 2010, 2000) guided the interpretation of the data. Schein (2000) described an organization's climate as a product of the organizational culture. Climate, the way in which members perceive the organizational environment, represents artifacts of the culture. It was my intent that a theory of organizational culture might contribute to our understanding of research training in residency.

This final chapter answers the research questions, positions the main findings of this research in relation to previous work, then highlights the main contributions for theory and practice. Finally, I present concluding directions for future research.

Overview of the Main Findings

This research identified shortcomings in the research training climate, proposed actions to resolve these shortcomings, highlighted how action research contributed to solving problems of practice in resident research training, and extended our understanding of research culture in this postgraduate training program.

Shortcomings Identified in the Research Training Climate

The results of the Research Training Environment Scale completed by residents in December 2013 suggested that the research training program has overall strengths on subscales

for wedding science and practice, emphasizing that all studies are flawed and limited, early minimally threatening involvement in research, science as a partly social experience, positive reinforcement of scholarly activities, and teaching residents to look inward for research ideas. However, residents reported lower scores for subscales related to faculty modelling of appropriate scientific behaviour, focus on varied investigative styles, and teaching relevant statistics and the logic of design.

Semi-structured interviews corroborated and elaborated upon these findings. Resident interviewees expressed frustration with the expectation for research in addition to the heavy clinical and academic expectations. However, they saw research as a source of satisfaction and recognized that their environment was such that they were better supported than other programs in terms of faculty interest, administrative support, and research opportunities. Faculty mentors stressed the importance of resident motivation for getting research done, and recognized that learning clinical anesthesia was residents' primary goal and research was secondary. In addition, faculty mentors expressed an appreciation for organizational support of research, including administrative support.

Residents and faculty mentors listed strengths of the research training environment as approachable and enthusiastic faculty – including established research faculty and members of the broader faculty base, the mandatory nature of research activities, a supportive program director, protected time, and research coordinator support.

When asked to reflect upon the results of the R-RTES, residents noted that the wider faculty group was generally supportive of research and willing to discuss ideas, but the research mentors were limited. Furthermore, residents and faculty described shortcomings in teaching

statistics and research design, expressed a certain level of comfort with the status quo of learning through experience, and highlighted faculty insecurities in coaching residents in statistics.

Comments pertaining to faculty involvement in research extended understanding of the R-RTES results, specifically as they related to faculty attitudes toward research, the number of available mentors, early exposure to research mentors, and mentoring relationships. Where "most faculty" are not involved in research, residents perceived a core group of researchers who were approachable and available to help with resident research. Regarding early exposure to faculty and the development of mentoring relationships, residents remarked that mentoring relationships are slow to start and take time to develop.

Relationship to previous literature. Residents identified many of the same challenges that have been identified in previous literature, most notably the lack of faculty mentors (Silcox et al., 2006; Warnick et al., 2003; Yager et al., 2004), and lack of comfort with statistics and research design (Spice et al., 2011; Susarla & Redett, 2014). Previous research has identified that only 24% of residents in American physical medicine and rehabilitation programs felt that they got adequate training in statistics, and 40% felt that they got adequate training in research design (Buschbacher & Braddom, 1995).

The current research extends understanding of faculty mentorship by identifying mentorship by a core group of researchers as distinct from scholarly mentorship that is provided by a larger faculty group. Compared to previous work which has highlighted lack of mentors as a barrier to participation in research (Silcox et al., 2006; Warnick et al., 2003; Yager et al., 2004), residents in this study highlighted that although there was a small group of faculty who mentor resident research, the larger faculty body was generally supportive of research and more than willing to discuss research ideas. While the importance of faculty involvement in resident

research training should not be underestimated, this study describes a research training environment where faculty involvement can be defined in different ways. Ahmad et al. (2013) demonstrated that programs that had >20% of faculty involved in research had higher rates of resident scholarly activity, but this neglects to account for faculty who can encourage resident research through scholarly attitudes.

To increase research mentorship among faculty, professional development opportunities were suggested in the form of a "Research 101" for faculty. However, the literature suggests that while mentoring development programs may increase self-perceived competency to mentor (Pfund et al., 2014) and research development programs may be well-received by faculty, they have not been successful at increasing faculty research productivity (Hindman, Dexter, Todd, 2013).

Based on DeHaven et al.'s (1998) classification, this research training program in anesthesiology could be described as relatively developed. Resident interviewees recognized that they were better supported than residents in other programs in terms of faculty interest, administrative support, and research opportunities. They listed strengths of the research training environment to include approachable and enthusiastic faculty – including established research faculty and members of the broader faculty base, the mandatory nature of research activities, a supportive program director, protected time, and research coordinator support. This is congruent with DeHaven and colleagues' (1998) classification of resident research programs, where relatively developed resident research programs were described as those which had the essential characteristics of an enthusiastic research champion, provision for time, faculty involvement as role models, journal clubs, access to a research professional, and a forum for presentation of trainee research. Furthermore, characteristics of successful research training programs deemed

extremely important by De Haven and colleagues (1998) included starting early, an integrated research curriculum, a requirement for a research project, broadly defining research, a focus on evidence-based medicine, visibility/bulletin board of research achievements, and a research committee to keep track of resident progress. In the current study, participants recognized that they were afforded thirty days of research time to be taken as needed to complete their project, and the Journal Clubs and annual resident research day were identified as useful contributions to the research environment. In addition, participants identified a focus on evidence-based medicine through the R-RTES, where the subscale Wedding Science and Practice received the highest mean score. These results, taken in the context of DeHaven's work, identify the current resident research program as relatively developed.

Despite the relatively developed status of the program in question, interviewees consistently expressed that clinical work is a greater priority than research. Schott, Emerick, Metro, and Sakai (2013) found that residents who elected for research involvement experienced fewer patient cases than those who did not elect to complete research rotations. To junior residents who are trying to find their bearings in a new environment, the thought of taking additional time away from clinical duties may be less than appealing.

Three Interventions Proposed to Improve the Research Training Environment

During semi-structured interviews, residents and faculty mentors identified several suggestions for enhancing the research climate. Short-term ideas for improvement included encouraging resident collaboration to share the workload, enhancing communication of research ideas, educating residents and mentors about roles, expectations, and resources, and increasing faculty involvement in research. Mid-term ideas for improvement included establishing an alternate funding plan for staff anesthesiologists that includes financial compensation for

academic time, encouraging interdisciplinary collaboration, fostering mentoring relationships, and emphasizing research achievements so more people want to be involved. Long-term ideas for improvement included suggestions to modify the Clinical Research Methodologies (CLR 800.3) course in which all first-year residents must partake, enhancing the statistics teaching for residents, initiating a Faculty Research 101 workshop or course, and hiring more research support staff such as a research assistant or PhD researcher in the basic sciences.

From these ideas presented to department members at Journal Club in April 2014, the actions that were chosen for implementation provided easily-achievable short-term goals. The first action for improvement was to ask senior residents and faculty to attend the Research Orientation for first-year residents on July 11th to enhance communication of ongoing and new research ideas, and provide earlier exposure to faculty. They were invited to speak briefly about their research interests, and any projects in particular that would benefit from involvement of junior residents. All interviewees felt that this was a useful exercise, but residents tended to think that the presentation by a senior resident was more helpful than those of faculty mentors. In addition, there were several suggestions made for continued improvement of this initiative.

The second action for improvement was the creation of a research section on our resident SharePoint site for enhanced communication of research ideas, and to offer examples of previous study protocols and ethics applications. This site was populated on June 25th, 2014 with the examples of study-related documents for a sample of active research projects, a list of research ideas proposed by faculty mentors, a description of the process for requesting research time and research funds, ethics application templates, and a curriculum seminar PowerPoint presentation on statistics. The residents voiced an appreciation for knowing where they could find resources

as the need arose, and both faculty and resident interviewees offered suggestions for further material that should be added.

The third action that was agreed upon to improve the program was to encourage resident collaboration by stating at the Research Orientation for new residents that "we encourage you to work together," by offering a range of options such as individual projects, new team projects, and joining ongoing projects. Follow up interviews highlighted resident reservations about collaborating with other residents, both in starting new projects and joining ongoing research projects. Most resident interviewees indicated a preference for starting their own project to working in teams or joining an ongoing project because they believed it would offer a more interesting opportunity for which they could feel a sense of ownership. However, they did propose a way to help each other with data collection while still maintaining autonomy over their own research. Follow up interviews also highlighted faculty reservations about residents working together, and suggested further work is required by the research team to define the parameters of resident collaborations.

Relationship to previous literature. Previous studies to address persistent challenges through implementation of various solutions to identified problems have mostly focused on development and implementation of new research training programs (Brubaker & Kenton, 2011; Kanna et al., 2006; Roth et al., 2006; Rothberg et al., 2014; Spice et al., 2011; Tulinius et al., 2012). While the results of the current study clearly indicate that there is room for improvement of the existing research training in our program, we chose to focus on specific, short-term actions that would produce early observable results. This research offered specific, ideas and measured the outcomes of these actions in a timely fashion.

The first action collaboratively decided upon to improve the research training environment was to enhance the Research Orientation for first-year residents by inviting faculty and senior residents to speak briefly about their research interests, and any projects in particular that would benefit from involvement of junior residents. This validates the number one suggestion made by Buschbacher and Braddom (1995) for improving the resident research experience: residents should be made aware of their program director, faculty, and research projects that are ongoing in the department. Furthermore, it corroborates the description of relatively developed research programs in family practice residency programs, where residents get involved in research early (DeHaven et al., 1998).

Although Rothberg and colleagues (2014) have stated their intention to focus future efforts on getting residents involved in research earlier in their training, this intervention has not been previously described in the literature as a method of enhancing the scholarly climate/culture in residency. While residents in the current study saw the value in early exposure to the research culture through the presentation of research ideas and mentors, it remains to be discovered whether this led to earlier involvement of residents in their own research projects. Interviewees in the current study commented that the research presentation portion of the orientation was helpful to both residents and faculty because the face-to-face contact initiated a feeling of comfort with faculty mentors, gave new residents a sense of what sort of research happens in the program, and, for faculty, provided a forum to share their research ideas.

The second action for improvement was the creation of a research section on our resident SharePoint site for enhanced communication of research ideas, and to offer examples of previous study protocols and ethics applications. Kanna et al. (2006) also described the provision of online research resources for residents during implementation of their structured resident

research training, but these were basic resources such as software and databases for literature searches. The creation of the research SharePoint site included having a centralized repository for research ideas, which was recently suggested in a commentary voicing the resident perspective about research training (Leucker & Stilman, 2014), but implementation of this initiative has not been previously described. In a survey conducted by Kenton and Brubaker (2007), program directors ranked the understanding of how to design research projects and of ethics in human research as the second and third most important components of research education programs (after an ability to interpret the medical literature). However, while PDs reported residents were very prepared to interpret the published literature, they were less ready to prepare a research protocol, prepare an ethics application, or write a manuscript. Residents and faculty mentors in the current study now have access to an online ideas list as suggested by Leucker and Stilman (2014), in addition to examples of other residents' study-related documents. While most interviewees had not yet accessed these online resources at the time of follow-up interviews, they felt appreciative that they would know where to find them when the need arose. In addition, they were able to contribute suggestions for further resources that would be helpful to share on the site.

The third action to improve the research training environment was to encourage resident collaboration by stating at the Research Orientation for new residents that "we encourage you to work together," by offering a range of options such as individual projects, new team projects, and joining ongoing projects. While an emphasis on resident research teams has been previously reported (Brubaker & Kenton, 2011), this was a prescriptive solution for all residents in the program. Participants in the current research were asking for flexibility in the options available to them, and for earlier communication of these options. Despite this request, follow up

interviews highlighted resident reservations about collaborating with other residents, both in starting new projects and joining ongoing research projects. Most resident interviewees indicated a preference for starting their own project to working in teams or joining an ongoing project because they believed it would offer a more interesting opportunity for which they could feel a sense of ownership. However, they did propose a way to help each other with prospective data collection, similar to that described by Brubaker and Kenton (2011) while still maintaining autonomy over their own research. By having a team of residents contributing to data collection, residents rotating through various services and sites can multiply the amount of time spent on recruitment for any one project by each accomplishing a part of it. It remains to be seen whether communicating the possibility of working in teams will lead to increased team research in the research program; however, it contributes to a collegial research climate.

How Action Research Contributed to Solving Problems in Resident Research Training

A secondary objective of this study was to discover what action research, as a dialectical process of co-generating solutions to practical challenges, could offer to our understanding of research training in residency. Residents and faculty were asked to comment on the extent to which this research project was able to achieve collaborative decision making and to solve the problems of practice that were identified in the research climate.

Overall, faculty and residents expressed positive reactions to the actions for improvement. They expressed the belief that this action research was successful in fostering an improved research training climate in the program. Reflection-on-action contributed to creating the impetus for improving the research climate of the department because "it's forced us to look at what are we doing, what can we be doing better, and how can we do it better" (Interview 6,

Resident). However, there was some lingering doubt on the behalf of faculty about our ability to see concrete results so soon.

Schein (2010) has asserted that the researcher's role in exposing organizational culture is to get at the shared basic assumptions and to understand how these assumptions evolve. By participating in this action research study, faculty and residents were exposed to a methodology that is not commonly employed in the medical sciences. This challenged traditional conventions of how evidence is established, which was evident in faculty mentors' responses to the question of whether action research has made a difference in the current study: In particular, the faculty comments demonstrated assumptions that evidence is established longitudinally, and revealed a lack of awareness about the purpose and intent of action research in addressing local challenges. This is contrary to the conventional hierarchy of evidence in medical sciences, with randomized controlled trials and meta-analyses at the highest level. However, another faculty response illustrated his reflective process as he came to realize that action research can use contextual evidence to produce substantive changes in a short timeframe. In hindsight, it would have been helpful if I had continued to present a graphic of the action research cycle to map the process, purpose and methods of action research.

A model for action research in resident research training is offered in Figure 2. Similar to previous work by D'Eon (1997), the current study began by Observing and Reflecting, prior to Planning and Acting. This model outlines the methods pursued in the current study. The observing phase included administration of the R-RTES and the semi-structured interviews. The reflecting phase included discussion of the results at a departmental journal club, and choosing from a list of possible improvements for opportunities that would produce the most easily achievable changes. The planning phase was achieved through collaborative decision-making

around the actions for improvement, and the action phase was accomplished through the implementation of these changes to the resident research orientation in July 2014. Follow up interviews were conducted to initiate a second observing phase. This completed action research cycle was followed by further suggestions from the residents, which were accepted by program leaders, prompting the beginning of an additional action research cycle.

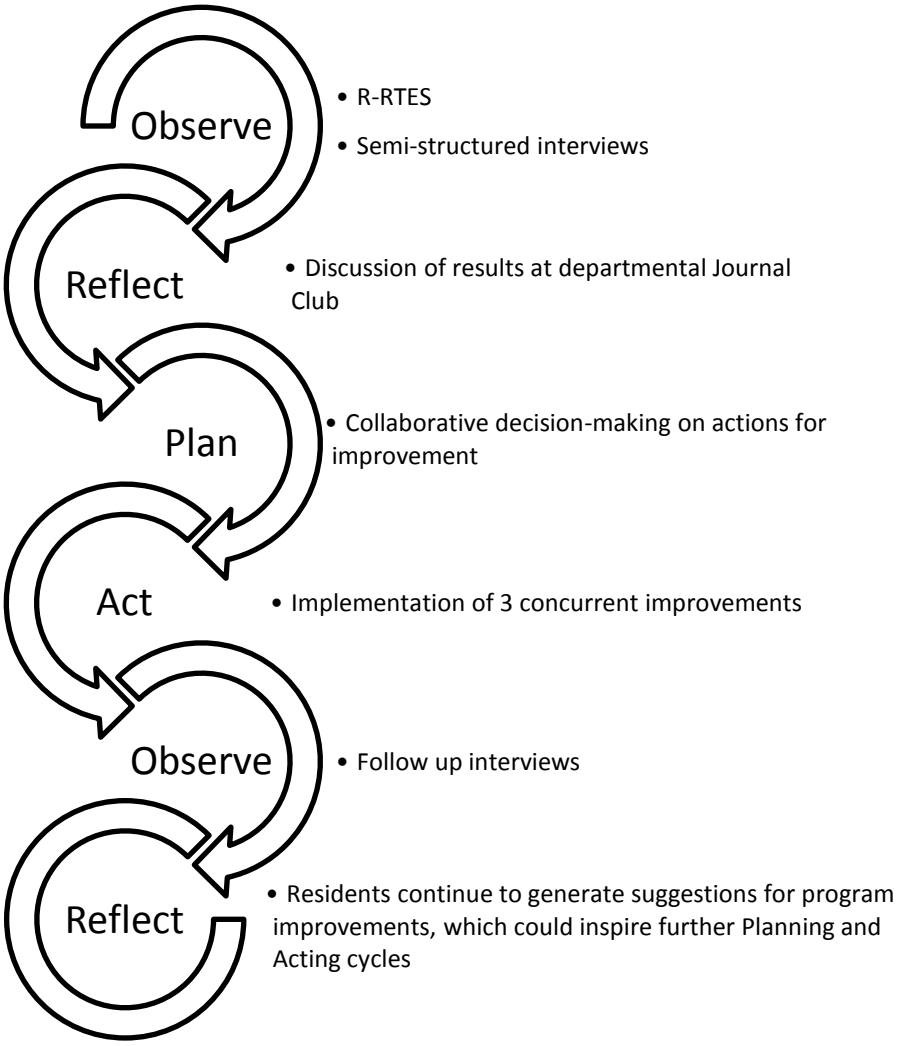

***Figure 2*. A model for action research in resident research training.**

Relationship to previous literature. The main purpose of action research is to solve a local problem of practice (Herr & Anderson, 2005). This research was successful in not only solving identified problems in the practice of research training for anesthesiology residents, but

also in generating an environment where residents were able to continue voicing their concerns with their research training, and the program faculty were receptive to resident suggestions. The participatory element of action research "affirms people's right and ability to have a say in decisions which affect them" (Reason & Bradbury, 2006, p. 10). Residents expressed appreciation for the opportunity to give feedback, as it made them feel like the research training they receive is a "malleable process" (Group Interview 1, Residents), attentive to those who are impacted by it. Faculty interviewees recognized that a large group of department members were able to give input into the process.

Among the five validity criteria for action research outlined by Anderson and Herr (1999), catalytic validity required that the research re-energize participants and leave them with a sense of transformed practice. By initiating the process of reflecting upon the research training program, residents and faculty provided suggestions for future improvement cycles during semi-structured interviews. Furthermore, residents made suggestions for improvement outside of the defined parameters of the current research, including a mechanism for improved feedback on their work in CLR 800, and flexibility in presenting a poster at the resident research day in either R1 or R2. The origin of these suggestions and the immediate outcomes are described in the following paragraphs.

After the discussion at Journal Club that determined three actions for improvement of the research training in anesthesiology, research issues arose again as the main issue for discussion at the Bear Pit on May 30, 2014. The Bear Pit provides a forum for residents to voice training concerns every three weeks, in the presence of the Program Director and Program Coordinator. The Bear Pit discussion that day centered on two topics: CLR 800 and the inaugural Bev Leech poster presentations for R1s that was held on May 4th, 2014.

Regarding CLR 800, the residents were concerned that there is little relevance to their anesthesia research projects because course instructors are based in the Department of Academic Family Medicine. They asked for a mechanism for the feedback on their assignments to be vetted by a member of the anesthesia research team, and for a change to the rubric that is used for grading assignments. I currently have access to see the course content and assignments, but do not grade any assignments. Additionally, I do not have the clinical expertise that the residents are hoping for in the appraisal of their assignments. Our Research Director agreed to read and comment on their assignments, but deferred action on recommending any changes to the rubric for grading assignments.

In response to the newly-initiated Resident Research Day poster presentations for R1s, residents commented that this was only convenient for the R1s who have a research idea they were planning on carrying through. Otherwise, they felt like they were presenting a "fake" project. They suggested that we allow for a poster presentation in either R1 or R2 to ensure they are getting feedback on an idea they plan to pursue. Residents also asked that we clarify to the judges that these are projects in progress so that the judges are not surprised that there are no results to share. They asked that the scoring rubric used by the judges be changed so as not to grade Results/Conclusions. All of these suggestions were accepted by the Program and Research Directors, suggesting that the current study was successful in achieving catalytic validity as described by Anderson and Herr (1999).

Previous work has highlighted the discrepancies that exist between resident and program directors' perceptions and attitudes pertaining to resident research training (Buschbacher & Braddom, 1995; Silcox et al., 2006). The collaborative nature of this action research forced participants to reckon with these divergent perspectives to choose shared actions for

improvement. Action research that involves multiple stakeholders may help to overcome discrepancies between residents and faculty when it comes to resident research training. In my experience with the current study, I observed that action research created a space for reflecting upon and discussing the issue of resident research training, with the goal of making positive changes for participants.

Research Culture in the Postgraduate Training Program

The final research question asked "What we can learn about the research culture of this post-graduate training program in anesthesiology?" The framework offered in Chapter 2 included two important considerations on which to base a study of resident research climate and culture. First, it outlined the three levels of culture in which cultural phenomena are observable: artifacts, espoused beliefs, and underlying assumptions (Schein, 2010). The main implication of outlining these three levels of culture for this study was to demonstrate that previous work has focused largely on integrating artifacts of successful research cultures and on identifying espoused beliefs of the involved actors. The underlying assumptions of research culture in these settings have not been described. Second, the framework recognized the external forces which drive resident research training, including the scholarly mandate set forth by accrediting agencies, the need for clinician scientists, and the call for improved patient outcomes.

The revised framework offered in Figure 3 illustrates the research culture in a single anesthesiology residency program, as elucidated through the current action research. Artifacts of the research culture and espoused beliefs about research training make up the climate of a research training environment. Underlying assumptions are the essence of a culture, those taken-for-granted beliefs which exist at an unconscious level. In addition, the culture is affected by the

external forces which act upon it, most notably the Royal College's transition to CanMEDS 2015 and its subsequent re-focusing of accreditation requirements.

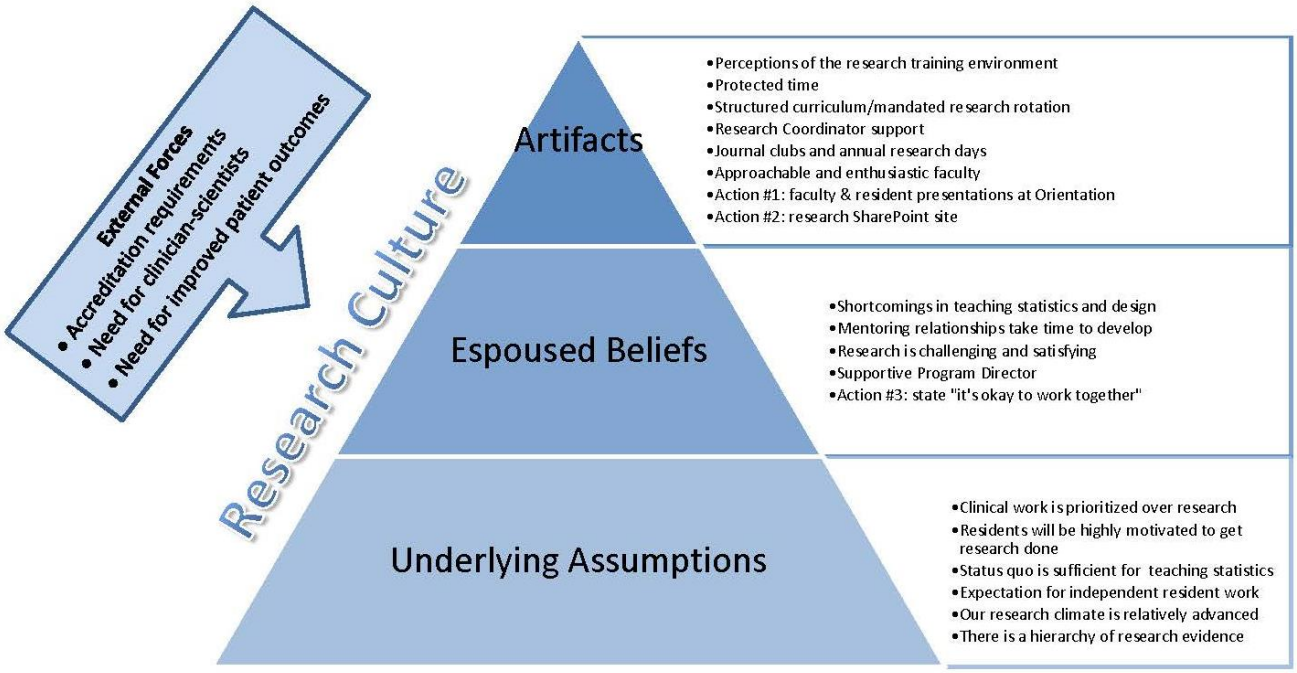

***Figure 3*. A conceptualization of research culture.**

In revisiting the conceptual framework that was offered in Chapter 2, one may conclude that the current study drew attention to the presence of many artifacts of successful resident research training in the program, including approachable and enthusiastic faculty – both established research faculty and members of the broader faculty base, the mandatory nature of research activities, a supportive program director, protected time, research coordinator support, journal clubs, and resident research days. One interviewee emphasized that the structure of the department contributes to shaping a culture that supports research. Additionally, role models were recognized as important visible personas for research which encourage others to become involved.

Espoused beliefs surrounding resident research included the attitudes which support or undermine successful research cultures and the level of satisfaction expressed by various actors. Residents and faculty mentors espoused a high level of support for resident research, recognizing that while research was "cumbersome," it was also very "satisfying." Interviewees recognized that there was a lot of support from the Program Director and the Department for resident research. However, they also commented that a culture change would be required to foster a more research-intensive environment. Furthermore, the high scores attributed to the R-RTES subscale "Wedding Science and Practice" should be recognized as residents' acknowledgement of the importance of medicine that is based on research evidence.

Despite high scores on the R-RTES subscale "Wedding Science and Practice," results suggest that the underlying assumptions of the research culture prioritize clinical work over research. Furthermore, the culture carries assumptions that residents will be highly motivated to get research done, and the expectation that residents will make an independent contribution. Several interviewees expressed a belief that our research climate is better than other anesthesia training programs across Canada, and other specialty training programs in the local College of Medicine. Additionally, in spite of an espoused belief in the importance of statistics and research design, results suggest that difficulty with statistics is commonly accepted, and the onus is on individual residents and faculty to independently apply themselves to learn these things.

These three levels of culture initially described by Schein (2010) must be considered within the scope of the external forces that drive resident research. The CanMEDS physician competency roles are undergoing a transition as the Royal College expands its definition of the Scholar role to include lifelong learning, critical appraisal, teaching, and research. This transition has de-emphasized the requirement for all residents to actually create knowledge

through research, and has presented it instead as an option. "The goal—although probably still through participation in research—is to produce informed research consumers for practice, recognizing that, likely with advanced training, some will choose the option of pursuing roles as clinical investigators or clinician scientists (researchers)" (Richardson et al., 2014).

Figure 3 helps to identify the discrepancies that exist between the cultural artifacts, espoused beliefs of its members, and the underlying assumptions that form the essence of the culture. Notably, results highlighted shortcomings in teaching statistics and research design; however, underlying assumptions that learning according to the status quo is sufficient, and the expectation for independent resident work are counterproductive to overcoming this challenge. Likewise, the third action chosen to improve the research training climate was to tell residents it is okay to work together, and to provide a range of options for research involvement. However, residents and faculty alike expressed concern that some residents would not meet the expectation for contributing an independent work.

Relationship to previous literature. Schein (2010) recommended identifying espoused values and underlying basic assumptions through group discussion as part of cultural assessment. Schein (2000) claimed that "[c]limate can be changed only to the degree that the desired climate is congruent with the underlying assumptions" (p. xxix). He argued that surveys of climate are insufficient for generating change; one must examine the underlying assumptions of the culture which manifest through members' perceptions of climate. In the current study, the results from the R-RTES assessment of research climate were used as a starting-off point for a discussion of participant's underlying assumptions about resident research. The symbols of research culture in residency have been previously described (O'Brien, 2013). However, the current study is the

first attempt to validate this conceptualization of research culture by gathering participants' underlying assumptions of the research culture in a residency program.

Two of the actions chosen to improve the research training environment were implemented at the research orientation for incoming R1s, which has implications for socializing newcomers into the research culture. Stating upfront that residents are allowed to work together on research projects and presenting examples of other resident and faculty projects demystified aspects of the research culture for new trainees. This is an example of Bolman and Deal's (2008) assertion that "[r]ituals of initiation induct newcomers into communal membership" (p. 262).

Specifically, resident interviewees commented that the presentation by a senior resident on the topic of his completed project was the most helpful aspect of the research orientation. In previous work, I have described how the sharing of successful experiences through storytelling can reinforce what the postgraduate program believes in (O'Brien, 2013). This senior resident was careful to state that he never thought of himself as a researcher, but was able to successfully complete a research project and present it at several conferences. This resident's success story is an example of what the research program holds possible for every resident who trains here.

Resident and faculty interviewees consistently expressed a belief that our research climate is better than other anesthesia training programs across Canada, and other specialty training programs in the College of Medicine. One resident interviewee offered the example of the College of Medicine resident research day, where anesthesia residents drastically out-represented other departments within the College. To the resident, this was evidence of our program's superior research climate. According to Bolman and Deal (2008), ceremonies "socialize, stabilize, reassure, and convey messages to external constituencies" (p. 266). It is

likely that interviewees' consistently-expressed belief in our superior research climate was reinforced by our residents' showing at this research day.

Researcher Reflections

A basic characteristic of action research is reflective practice. Additionally, Schön's (1984) theory of Reflection-in-Action is a process whereby professionals reflect upon tacit assumptions to reconcile action and understanding. This research highlighted several aspects of research training, postgraduate medical education research culture, and my professional practice for me that I feel are worth mentioning.

In terms of research training, my perception of our program was refined by making the connection with previous literature to identify our program as relatively developed (DeHaven et al., 1998). By so doing, I was able to clarify my thoughts around why we were still experiencing many challenges identified in the literature while simultaneously being seemingly more advanced than other programs within our local College of Medicine. In addition, the interviews provided the opportunity to hear members' perceptions that our research training is also more advanced than most Canadian anesthesiology programs. As a result, I was able to recognize our accomplishments along with the opportunities for improvement through action research, thus providing an opportunity for personal growth.

Research culture in postgraduate medical education is a new idea. Despite my previous work which has conceptualized this construct (O'Brien, 2013), the current study was the first opportunity to elucidate resident and faculty perceptions of this research culture. I was intrigued to map the ideas and recognize disconnect between some of the artifacts, espoused beliefs, and underlying assumptions. Among Anderson and Herr's (1999) validity criteria for action research, outcome validity addressed whether the research lead to a resolution of the problem

and reframed the question in a more complex way that lead to a new set of questions to be addressed. While the current study was effective at implementing three collaboratively chosen actions to address challenges in research training climate, it also opened the possibility for future work to align some of the artifacts, espoused beliefs, and underlying assumptions in the resident research culture. The current study did not achieve double-loop learning according to Argyris and Schön, focusing instead on organizational effectiveness (single-loop learning). However, it highlighted opportunities where double-loop learning could be pursued in subsequent action research cycles.

In action research, the researcher is an active participant in problem solving (Greenwood & Levin, 2007). This principle was most evident to me at the Journal Club, where discussion resulted in the selection of three actions for improvement. With my focus on collaboration in the decision-making phase of this study, I was taken aback when, after presenting results from the quantitative and qualitative phases of this study, our Research Director asked me what I would recommend. His rationale was that I was more familiar with the material than everyone else present. Initially, I saw this as a shirking of responsibility and a deflection of attention. However upon reflection, I now consider this to be recognition of my active participation in problem solving. I had hoped to emphasize collaboration, and in so doing, obtain all the answers from faculty and residents. However, this would neglect my central role as the Research Coordinator, a practitioner whose purpose is to administer the resident research program. Instead, I channeled problem solving in my role as practitioner-researcher, facilitating inadvertent triangulation of results in the group discussion that resulted in actions for improvement.

Contributions to Theory and Practice

This research contributed to practice by identifying and reflecting upon local challenges, in addition to planning and acting upon suggestions for improving the research training environment. Practical implications may be identified as the three actions that were chosen by faculty and residents: 1) to include faculty and senior residents' presentation in the research orientation, 2) the creation of an online repository of research resources, and 3) encouraging a range of options for engaging in research, including the possibility of working in teams. Furthermore, this research generated additional ideas for improvements that can be addressed through future action research cycles.

This research contributed to theory in two main ways. First, this study shaped a model whereby action research could be used in a pre-existing resident research training program. Medical educators have lacked a model for overcoming persistent challenges to pre-existing resident research programs, but a model for action research in resident research training is now available (Figure 2). This is the first study to recognize specific local challenges to a relatively developed resident research program and to collaboratively generate solutions among residents and faculty mentors. This study is also the first example of applying the R-RTES to highlight items that are scored relatively high or low, aiding in the identification of strengths and weaknesses of the research climate. Subsequently, discursive reflection on the shortcomings of the research training climate as perceived by residents and faculty mentors, and collaborative generation of solutions benefitted trainees and faculty by responding to the needs, values, and priorities of this specific practice setting.

Secondly, this study contributed to theory through further conceptualizing research culture in postgraduate medical education. In considering improvement of resident research

training through a lens of organizational culture, I contribute to existing theory by illuminating the underlying cultural assumptions in one Canadian resident research program in anesthesiology. In addition, Figure 3 illustrates the disconnect that exists between the artifacts and espoused beliefs that make up the research climate, and the underlying assumptions that form the essence of the research culture in this postgraduate program.

Future Research

Follow up with subsequent action research cycles in this residency training program to determine long-term impact of the actions for improvement, such as increased team projects, publications and presentations, is warranted. Further administration of the R-RTES could enable quantitative comparison of resident perceptions of the research training environment over time and between programs. Further research is required to determine if the collaborative methods of action research can be successfully applied in other residency programs. Moreover, elucidating the research culture in other residency programs would provide a fuller picture of research culture in post-graduate medical education (PGME), and allow for comparison of the underlying assumptions that form the essence of research culture across programs.

Concluding Comments

This action research has employed a three-phase, sequential mixed methods design to understand the research training climate in anesthesiology at the University of Saskatchewan, and to collaboratively determine strategies for addressing persistent challenges to resident research training. The use of action research to identify shortcomings, generate solutions, and collaboratively choose actions for improving the research training program inspired changes to the research climate including 1) the addition of presentations by faculty and senior residents at the research orientation for new residents, 2) the creation of an online repository of research

resources, and 3) allowing a range of options for engaging in research, including the possibility of working in teams. Furthermore, during the course of this research, residents and faculty engaged in reflection-on-action and highlighted several additional suggestions for future action research cycles. Most notably, this research offers two main contributions to theory. First, this study produced a model whereby action research could be used in other pre-existing resident research training programs locally, nationally, and internationally. Second, this study conceptualized research culture in one postgraduate medical education program, specifically by elucidating some of the underlying assumptions that form the essence of the culture. In considering improvement of resident research training through a lens of organizational culture, I illuminated the underlying cultural assumptions in one Canadian resident research program in anesthesiology. Future research in other PGME programs to apply the model for action research in resident research training is required. Likewise, there remains a need to expose the underlying assumptions of other research cultures in PGME to form a more comprehensive understanding of how research culture is affected by shifting external forces, and how patient outcomes may be impacted by research culture in medical training.

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APPENDICES

Appendix A - Research Training Environment Scale

Description:

A 54-item measure of nine of the ingredients of the Research Training Environment (RTE) described by Gelso (1993).

Below is a series of statements concerning research training.

Please note: We define research broadly. "Research" when used in this survey includes the following types of activities: designing and executing research projects, preparing manuscripts of a theoretical nature or a critical review of literature, conducting program evaluations or needs assessments, making presentations at professional conferences, participating as a member of a research team engaged in any of the above activities, and advising the research projects of others.

Please respond to the following statements in terms of the doctoral program in which you are currently receiving your training. (Note: If you are currently on internship, please rate the graduate program in which you were previously trained.) Consider each statement using the following scale:

1 = Disagree 2 = Somewhat disagree 3 = Neutral 4 = Somewhat agree 5 = Agree

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1. In general, my relationship with my advisor is both intellectually stimulating and interpersonally rewarding. (If your advisor has been newly assigned or chosen, respond in terms of what you expect the relationship to be.)

2. My graduate program rarely acknowledges the scholarly achievements of students.

3. Many of our faculty do not seem to be very interested in doing research.

4. The faculty does what it can to make research requirements such as the thesis and dissertation as rewarding as possible.

5. The faculty here only seem to notice a few selected students in terms of reinforcing scholarly achievements.

6. My graduate program provides concrete support for graduate student research (e.g., access to computers, travel money for making presentations, research supplies, or free postage for mailing surveys).

7. I feel that my advisor expects too much from my research projects.

8. There is informal sharing of research ideas and feelings about research ideas in my program.

9. My advisor understands and accepts that any piece of research will have its methodological problems.

10. Faculty members often invite graduate students to be responsible collaborators in the faculty members' own research.

11. I was encouraged to get involved in some aspects of research early in my graduate training.

12. Because of the diversity of research approaches among faculty members in my program, I would be able to find help learning about virtually any major research approach, e.g., field, laboratory, experiential, qualitative.

13. In my graduate training program there are opportunities to be part of research teams.

14. I have felt encouraged during my training to find and follow my own scholarly interests.

15. My training program faculty tends to produce research that is not clinically relevant.

16. The research climate here is one in which students can get in touch with their own curiosity and with the research questions they themselves want to ask.

17. Many different research styles (e.g., field vs. laboratory) are acceptable in my graduate program.

18. The faculty members of my graduate program enjoy discussing ideas.

19. Much of the research we become involved in prior to the thesis is organized in a way that is highly anxiety provoking to students.

20. Students in my program receive sound training in how to design and logically analyze research studies.

21. I have gotten the impression in my graduate training that my research work has to be of great value in the field to be worth anything.

22. The faculty in my graduate training program is involved in the conduct and publication of high quality research (or theory).

23. Statistics courses here are taught in a way that is insensitive to students' level of development as researchers.

24. We do not receive sound training in my program on applied, practical, and less traditional approaches to research.

25. The statistics courses we take do a good job, in general, of showing students how statistics are actually used in psychological research.

26. There is a sense around here that being on a research team can be fun, as well as intellectually stimulating.

27. Students here are encouraged to at least begin thinking about one or more topics upon which they would like to conduct programmatic research (i.e., a series of studies in which one builds upon another).

28. My graduate training program has enabled me to see the relevance of research to clinical service.

29. The faculty members of my graduate program encourage me to pursue the research question in which I am interested.

30. My advisor offers much encouragement to me for my research activities and accomplishments.

31. Faculty members in my program use an extremely narrow range of research methodologies.

32. In my research training, the focus has been on understanding the logic of research design and not just statistics.

33. Some of the faculty teach students that during a phase of the research process, it is important for the researchers to "look inward" for interesting research ideas.

34. Generally, students in my training program do not seem to have intellectually stimulating and interpersonally rewarding relationships with their research advisors.

35. It is unusual for first-year students in this program to collaborate with advanced students or faculty on research projects.

36. There seems to be a general attitude here that there is one best way to do research.

37. I have the feeling, based on my training, that my thesis (or dissertation) needs to be completely original and revolutionary for it to be acceptable to the faculty.

38. The faculty does not seem to value clinical experience as a source of ideas for research.

39. We get high quality training here in the use of statistics in applied research, e.g., counseling research.

40. I get the impression from my training that, although a single study does not revolutionize thinking in the scientific community, such a study can contribute a useful piece to an unfolding body of knowledge.

41. This training environment promotes the idea that although parts of research must be done alone, other parts may involve working closely with other colleagues.

42. Our statistics instructors are generally sensitive to students' anxieties and feelings about statistics.

43. Our faculty seems interested in understanding and teaching how research can be related to counseling practice.

44. Most faculty do not seem to really care if students are genuinely interested in research.

45. During our coursework, graduate students are taught a wide range of research methodologies, e.g., field, laboratory, survey approaches.

46. During their first year in the program, students take a research course aimed at developing research skills, interests, and confidence.

47. I feel that I need to choose a research topic of interest to my advisor at the expense of my own interests.

48. There is a prevalent viewpoint in my training program that research findings can be used to improve clinical practice.

49. Students in our program feel that their personal research ideas are squashed during the process of collaborating with faculty members, so that the finished project no longer resembles the student's original idea.

50. Students here seem to get involved in thinking about research from the moment they enter the program.

51. Students in this program are rarely taught to use research findings to inform their work with clients.

52. The faculty members here are quite open in sharing their research with their students.

53. The faculty members of my graduate program show excitement about research and scholarly activities.

54. Much of the research we become involved in prior to the thesis is intellectually challenging and stimulating.

Scoring:

Reverse score #2, 3, 5, 7, 15, 19, 21, 23, 24, 31, 34, 35, 36, 37, 38, 44, 47, 49, 51

Sum items within each subscale, or sum all 54 items to attain a total score.

Faculty Modeling = 3, 10, 18, 22, 52, 53
Positive Reinforcement = 2, 4, 5, 6, 30, 44
Early Involvement in Research = 11, 19, 35, 46, 50, 54
Teaching Relevant Statistics = 20, 23, 25, 32, 39, 42
Looking Inward for Ideas = 14, 16, 29, 33, 47, 49
Science as a Social Experience = 1, 8, 13, 26, 34, 41
All Experiments are Flawed = 7, 9, 21, 27, 37, 40
Focus on Varied Investigative Styles = 12, 17, 24, 31, 36, 45
Wedding Science and Practice = 15, 28, 38, 43, 48, 51

Appendix B - Semi-Structured Interview Questions

1. Year of training?
2. Gender?
3. Previous graduate degree?
4. Stage of your research project?
5. What do you perceive as the main strengths of the research training program in anesthesiology?
6. What do you perceive as the main areas for improvement?
7. Reflect upon the results of the R-RTES. What sticks out for you? Can you offer an explanation for the results? What do you think they demonstrate about the research training environment?
8. What can we assume about the research training environment?
9. What suggestions can you make for improving the research training that you have received so far?
10. Of these suggestions, can you identify the three you consider the most important?
11. Are you interested in participating in an advisory committee which will decide upon actions to improve the research training environment in anesthesiology?

Thank you so much for your time!

Appendix C - Ethics Application Documents

For administrative use only	
File Number:	Date received:

University of Saskatchewan | University of Regina | Regina Qu'Appelle Health Region

Application for Behavioural Research Ethics Review

Evaluating Applications

The matters of greatest concern to the Behavioural Research Ethics Board (Beh-REB) are the issues of informed consent of participants, voluntary participation, protection of individual privacy (confidentiality and anonymity), and safeguarding participants from any harmful results due to participation or non-participation in the proposed investigation or research project. Our evaluation of an application is based on the degree to which each of these concerns are satisfied; when filling out the application, researchers are urged to consider these points, and to explain to the Beh-REB the steps they will take to address the concerns. Researchers are also urged to consult the Tri-Council Policy Statement 2 for more information and guidance.

The Beh-REB acknowledges the variety of paradigms and methodologies currently available to researchers, and that each of these paradigms entails its own particular ethical issues. Thus, there may be more than one way to address an ethical issue. Researchers should feel free to suggest alternative approaches or to explain why a particular requirement is not appropriate in the context of a given project.

All text boxes will expand once <Enter> is selected or the cursor moves to the next section.

PART 1: IDENTIFICATION		
1.1	**Project Title GN 1.1**	
	Resident research in anesthesiology: Enhancing research training through action research	
1.2	**Principal Investigator GN 1.2**	
	Full Name:	Vivian Hajnal
	Mailing Address:	Office ED 3063 College of Education, University of Saskatchewan, 28 Campus Dr., Saskatoon, SK. S7N 0X1
	Email: vivian.hajnal@usask.ca	Phone: (306) 966-5675
	NSID number (U of S faculty only):	
1.3	**University/Institutional Affiliation of Principal Investigator GN 1.3**	
	Position:	Associate Professor
	Department:	Department of Educational Administration
	Division:	
1.4	If this is a student/graduate/resident project, please provide the following information: GN 1.4	
	a) Student Name(s) and Student ID or NSID (s):	Jennifer O'Brien, jmo122
	b) Supervisor Name:	Vivian Hajnal
1.5	**Project Personnel (include graduates/post graduates/residents): GN 1.5**	Add Personnel | Remove Last
	Full Name:	Jennifer O'Brien
	Project Position/Role:	Sub-Investigator, PhD Candidate
	University/Institutional Affiliation:	University of Saskatchewan
	Email: Jennifer.OBrien	Phone: 306-655-6497

1.6	**Primary Contact Person for Correspondence (if different than Section 1.2)** GN 1.6 Full Name: Jennifer O'Brien Mailing Address: Royal University Hospital G525-103 Hospital Drive Saskatoon, SK S7N 0W8 Email: Jennifer.OBrien@saskatoonhealthregion.ca Phone: 306-655-6497
1.7	Research Site(s) where project will be carried out: University of Saskatchewan, Department of Anesthesiology
1.8	1.8.1 Proposed Project Period: GN 1.8 From (MM/DD/YY) 12/01/13 To (MM/DD/YY) 11/30/14
1.9	**1.9.1 Has this project applied for and/or received ethical approval from any other Research Ethics Board? Will you be seeking REB approval through the Sask. ethics harmonization process?** GN 1.9 ☐ Yes ☒ No **1.9.2 Please be advised that approvals may need to be sought if you are collecting data from schools, within health regions and may be required from other organizations, agencies, or community groups. Will you be contacting potential participants or collecting data from any such organizations?** GN 1.9.2 ☐ Yes ☒ No
1.10	1.10.1 Status of Funds: GN 1.10 ☐ Awarded ☐ Pending ☒ **Unfunded**

PART 2: CONFLICT OF INTEREST

2.1	**2.1.1 Is there any real, potential or perceived conflict of interest (any personal or financial interest in the conduct or outcome of this project)?** GN 2.1 There is a potential conflict of interest in that Jennifer O'Brien is contracted as the Research Coordinator in Anesthesiology and has a vested interest in maintaining this contract. **2.1.2 Will any of the researcher(s), members of the research team and/or their immediate family members:** · Receive personal benefits in connection with this project over and above the direct costs of conducting the project, such as remuneration or employment? · Receive significant payments of other sorts from the sponsor such as grants, compensation in the form of equipment or supplies or retainers for ongoing consultation and honoraria? · Have a non-financial relationship with a sponsor (such as unpaid consultant, board membership, advisor or other non-financial interest? · Have any direct involvement with the sponsor such as stock ownership, stock options or board membership. · Hold patents, trademarks, copyrights, licensing agreements or intellectual property rights linked in any way to this project or the sponsor? · Have any other relationship, financial or non-financial, that if not disclosed, could be construed as a conflict of interest? ☒ Yes ☐ No **Please describe the personal benefits or relationship.** Jennifer O'Brien is contracted to the Department of Anesthesiology as the Research Coordinator, and has a direct personal interest in maintaining this contract. However, the proposed study aims to improve the research training provided to residents in Anesthesiology. We argue that program evaluation and improvement falls within the scope of this contract.
2.2	Have any restrictions regarding access to or disclosure of information (during or at the end of the project) been placed on the investigators? This includes controls placed by the sponsor, funding body or advisory committee. ☐ Yes ☒ No

PART 3: BRIEF OVERVIEW OF RESEARCH PROJECT

3.1	**Briefly describe the project, its objectives and potential significance (250-500 words): GN 3.1** The purpose of this action research study will be to understand the research training climate in Anesthesiology at the University of Saskatchewan, and to collaboratively determine strategies for addressing persistent challenges to resident research training. This study is guided by the belief that collaborative engagement by resident trainees and faculty mentors will result in improvement of the research programme, and enhancement of the residency program's research climate and scholarly culture. The roles of organizational climate and culture in resident research programs have not been explored. This study is designed to answer the following research questions: 1) What can action research, as a dialectical process of co-generating solutions to practical challenges, offer to our understanding of research training in residency? 2) What shortcomings in the research training climate will be identified by residents and faculty in Anesthesiology at the University of Saskatchewan? 3) When afforded the opportunity to collaborate in improvement of the resident research program, what three interventions will be proposed by residents and faculty to achieve the ideal resident research training environment? Although the challenges to resident research training have been consistently described in the literature, medical educators lack a model for overcoming persistent challenges to resident research. This study is the first attempt to apply action research and the principles of organizational learning to the persistent challenges in resident research training. It will take a local, collaborative approach to generate priorities for improvement based on first-hand experiences of residents and faculty with the local research training program. By discursively reflecting on the shortcomings of the research training climate as perceived by residents and faculty mentors in a local residency program, and by acting upon collaboratively-generated solutions to a practical problem, there may be a net benefit to trainees, faculty, and the College of Medicine by responding to the needs, values, and priorities of this specific practice setting. Furthermore, this study may produce a model to demonstrate the feasibility of using action research to improve resident research training for other local, national, and international programs.
3.2	**Provide a description of research design and methods to be used: GN 3.2** A three-phase, sequential mixed methods design will be employed to 1) identify shortcomings in the research training climate, 2) explore resident and faculty perceptions of the underlying reasons for these shortcomings, and 3) explore the impact of the co-generated solutions initiated as three sequential action research cycles. In the quantitative phase, the entire population of 35 residents across five years of postgraduate training will complete the revised Research Training Environment Scale (R-RTES) (Gelso, Mallickrodt, & Judge, 1996) as part of a Program Evaluation of the research training program in anesthesiology. The R-RTES measures the research training environment in anesthesiology on nine subscales: 1) faculty modeling of appropriate scientific behavior, 2) positive reinforcement of scholarly activities, 3) early, minimally threatening research involvement, 4) teaching relevant statistics and the logic of design, 5) teaching students to look inward for research ideas, 6) science as a partly social experience, 7) emphasizing that all studies are flawed and limited, 8) focus on varied investigative styles, and 9) wedding of science and clinical practice. Quantitative data from the R-RTES will be analyzed by summing the six items within each subscale to identify areas of perceived shortcomings. The qualitative phase will follow the Program Evaluation. A conveniently-selected subsample of at least two residents from each postgraduate year of training (2x5=10 residents) and four faculty research mentors in anesthesiology will be selected by the researcher who is also the Research Coordinator in Anesthesiology. Residents and faculty mentors will be invited to engage in semi-structured interviews and focus groups of 2-4 participants, to explore the underlying reasons for identified shortcomings, and to generate ideas for solutions to guide three simultaneous action research cycles. Qualitative data from recorded interviews and focus groups will be analyzed according to the reflexive and iterative process described by Halcomb and Davidson (2006). This process involves 1) audiotaping of interview and concurrent note taking; 2) reflective journaling immediately post-interview; 3) listening to the audiotape and amending/revising field notes and observations; 4) preliminary content analysis; 5) secondary content analysis; 6) thematic review. An advisory committee of approximately 6 members will review findings from interviews and focus groups, and will collaboratively decide upon actions for improvement. The third phase will follow the initiation of three action research cycles to reflexively evaluate the impact of these actions following their implementation.
3.3	Provide details regarding the duration and location of data collection event(s): GN 3.3 ☐ Questionnaire ☒ Individual Interviews ☐ Group Interview ☒ Video/audio recording ☐ Home Visits ☐ Other: ☐ Participant Observation ☒ Focus Groups ☐ Non-invasive physical measurements ☒ Secondary use of data or analysis of existing data ☐ Ethnography

PART 4: PROJECT DETAILS

4.1	**4.1.1 Will you have any internet-based interaction with participants? GN 4.1** ☐ Yes ☒ No
4.2	**4.2.1 Will your research involve Aboriginal Peoples including First Nations, Inuit and Métis peoples? GN 4.2** ☐ Yes ☒ No
4.3	**4.3.1 Will the project involve community-based participatory research? GN 4.3** ☐ Yes ☒ No
4.4	**Will deception of any kind be necessary in this project? GN 4.4** ☐ Yes ☒ No
4.5	**Indicate how the participants will be debriefed following their participation (if applicable), and describe how the information on the results of the research will be made available to participants once the study has ended. Debriefing is particularly important if deception has been used. GN 4.5** Participants may choose to become involved in the Advisory Group that will determine the interventions to improve the research training program in Anesthesiology. Furthermore, the researcher will offer an oral presentation within the Department of Anesthesiology upon completion of the research. Those participants who wish to access the full report will be directed toward the electronic dissertations and theses database of the University of Saskatchewan.
4.6	**Will participants be compensated? GN 4.6** ☐ Yes ☒ No
4.7	**4.7.1 Will participants be anonymous in the data gathering phase of the study? (Anonymous means that no link can be established between the participant and the research - no one including the researcher knows who has participated in the research):** ☐ Yes ☒ No **4.7.2 Will the confidentiality of participants and their data be protected? (Confidentiality means that no link can be established between the collected information and the participant's identity)** ☒ Yes ☐ No **4.7.3 If yes, are there any limits to confidentiality:** ☒ **Limits due to the nature of group activities (e.g. focus groups): the researcher cannot guarantee confidentiality** ☒ **Limits due to context: individual participants could be identified because of the nature or size of the sample or because of their relationship with the researcher.** ☐ **Limits due to selection: procedures for recruiting or selecting participants may compromise the confidentiality of participants (e.g. participants are referred to the study by a person outside the research team)** ☐ Other:

PART 5: ESTIMATION OF RISKS AND BENEFITS

5.1

5.1.1 Do you consider this project to be: GN 5.1

☐ Minimal Risk ☒ Above Minimal Risk

5.1.2 Indicate if the participants might experience any of the following:

Risk of psychological or emotional harm or discomfort (e.g. trauma, anxiety, stress)

n/a

Legal repercussions for participating in the study(e.g. possibility of being sued, charged with criminal activity, disclosure of past or future criminal activities, etc.)

n/a

Social repercussions (e.g. ostracized, being negatively judged by peers or employer, fired from your job)

Because the participants come from a small group of people who all know each other, there may be a risk of social repercussions from peers or faculty members, although this is not anticipated.

Risk of physical harm or discomfort (e.g. falling, muscle pain, tiredness, weakness, nausea)

n/a

5.1.3 Describe how the risk will be managed (including an explanation as to why an alternative approached could not be used). If appropriate, identify any resources, e.g. physician or counselor, to which participants can be referred. GN 5.1.3

Interviews will be conducted by Jennifer O'Brien, the Research Coordinator in Anesthesiology. Participants will be asked to respect the privacy and confidentiality of their peers, and participants will be informed that confidentiality cannot be guaranteed. To minimize the risk of coercion, any grades or assessments made by the Research Coordinator during the course of this research will be co-graded or co-evaluated by one of the Research Directors or a member of the Clinical Research Methodologies staff.

5.1.4 If above minimal risk, what are the likely benefits of the research to the researcher, participant, the research community and society that would justify asking participants to participate? GN 5.1.4

By participating in this research, participants will have an opportunity to directly influence the resident research program in Anesthesiology by identifying its shortcomings, proposing solutions, and advising on the choice of interventions to improve the research training environment. I expect that working collaboratively with residents and faculty to improve the research training environment in Anesthesiology will result in improved attitudes toward research and an improved educational climate, but this is not guaranteed. Furthermore, this study may serve as an example of action research to be used by other residency programs to improve local research training programs.

PART 6: PARTICIPANT RECRUITMENT

6.1

Describe the participants and the criteria for their inclusion or exclusion. Indicate the number of participants and a brief rationale for the intended number of participants: GN 6.1

The Program Evaluation phase will be completed by all 35 anesthesiology residents at the University of Saskatchewan during a teaching seminar on statistics on December 13, 2013. Participants for the qualitative phase will be sought from among these respondents and the 10 faculty who are actively engaged in research mentorship. I will aim to recruit at least two residents from each postgraduate year of training (2x5=10 residents) and four faculty mentors, but no one will be precluded from participation if they would like to be included.

6.2

6.2.1 Provide a detailed description of the method of recruitment. GN 6.2

Participants for the qualitative phase will be sought from among the residents participating in the Program Evaluation phase during the curriculum seminar on statistics, December 13, 2013. In addition, faculty who are actively engaged in mentoring resident research will be invited via email or in person (the usual way the researcher communicates with resident research mentors).

6.2.2 How will prospective participants be identified?

A conveniently-selected subsample of participants will be selected for the qualitative phase by the researcher who is also the Research Coordinator in Anesthesiology. Using tacit knowledge obtained through practice (Schon, 1984), invited resident participants will represent those who experienced challenges and successful experiences relating to research topic selection, mentorship, and data collection. Invited faculty mentors will represent both those with relatively modest and relatively substantial experience in mentoring resident research projects (from experience with a mentoring a single resident research project, up to over a decade of resident research mentoring experience).

6.2.3 Who will contact prospective participants? Describe the source of the contact information, how they will be contacted and as applicable, who originally collected the contact information. Ensure any letters of initial contact or other recruitment materials are attached, e.g. advertisements. flyers, telephone script, etc.

The researcher, who is also the Research Coordinator in anesthesiology, will contact prospective participants in person and via email from the existing contact information used as part of my work with the Resident Research Program. This contact information has been collected by residency program staff and provided to the Research Coordinator for the purposes of facilitating resident success in their research requirement.

6.3	**In cases where the research involves special or vulnerable populations, distinct cultural groups, or in cases where the research is above minimal risk, the researcher should describe their experience or training in working with the population. If none of these criteria apply, this section may be omitted. GN 6.3** The researcher has worked closely with the prospective participants to facilitate their successful completion of the resident research requirement since Decemebr 2007.
6.4	**Where relevant, please explain any relationship (pre-existing, current or expected to have) between the researcher(s) and the researched (e.g. instructor-student, manager-employee, co-workers, family members/intimate relationships, etc). Please pay special attention to relationships in which there may be a power differential. Describe any safeguards and procedures to prevent possible undue influence, coercion or inducement. GN 6.4** The researcher has two distinct relationships with the prospective participants in this study. Although power may influence my relationships with participants, its impact would be difficult to resolve because I am subordinate to the program director, research directors, and faculty as a contracted employee. However, I am responsible for contributing input into resident research evaluations, which places me in a position of power over residents. These risks will be mitigated by requiring all evaluations and assessment to utilize a co-evaluator during the course of the research.

PART 7: CONSENT PROCESS

7.1	**Describe the process that will be used to obtain informed consent. Please note that it is the content of the consent, not the format that is important. If the research involves collection of personally identifiable information from a research participant or extraction of personally identifiable information from an existing database, please describe how consent from the individuals or authorization from the data custodian will be obtained. If there will be no written consent, please provide a rationale for oral or implied consent (e.g., cultural appropriateness, online questionnaire, etc.) and explain how consent will be recorded.** **7.1.1 Describe the consent process. GN 7.1** Informed consent for participation in interviews and focus groups will be sought from residents at the curriculum seminar in statistics, to be taught by the Research Coordinator on December 13, 2013. The researcher will explain the purpose of research training improvement through collaborative action research, and that participation is entirely voluntary. Informed consent will be sought individually from faculty mentors in the Department of Anesthesia prior to their participation in a semi-structured interview or focus group. **7.1.2 Who will ask for consent?** Jennifer O'Brien will ask for consent. **7.1.3 Where, and under what circumstances will consent be obtained?** For residents, consent will be obtained in the Department of Anesthesia after the Program Evaluation phase, and prior to participation in semi-structured interviews or focus groups. Residents will have as much time as they need to decide whether or not to participate (up to 1 month), and they can approach the researcher if they are interested in participating. For faculty, consent will be obtained in the Department of Anesthesia at a time that is convenient to their clinical and academic workloads. **7.1.4 Describe any situation in which the renewal of consent for this research might be appropriate and how this would take place (e.g. longitudinal studies, multiple data collection events, etc.).** Renewal of consent for the follow-up interviews and focus groups will be conducted verbally prior to the follow-up interviews.
7.2	**If any or all of the participants are children and/or are not competent to consent, describe the process by which capacity/competency will be assessed, the proposed alternate source of consent - including any permission/ information letter to be provided to the person(s) providing the alternate consent - as well as the assent process for participants. GN 7.2** N/A
7.3	**Describe your plans for providing project results to the participant? GN 7.3** In addition to the direct application of participant-generated results to the improvement of the Resident Research Programme in Anesthesiology, a lay-language summary of results will be posted on the Department of Anesthesia's publicly available website, http://www.medicine.usask.ca/anesthesiology/division-of-research/index.php
7.4	**How and when are participants informed of the right to withdraw? What procedures will be followed for participants who wish to withdraw at any point during the study? GN 7.4** Participants are informed of their right to withdraw during the invitation to participate that will follow the program evaluation phase, and again during the informed consent process. Participants will be free to withdraw at any point in the study, up to 1 month following the semi-structured interviews. If participant participated in an individual interview, audio recording and interview notes will be destroyed. If participant participated in a group interview, this will not be possible. Participants may choose to withdraw prior to participation in the interview, to terminate the interview early, or to decline to answer any of the questions.

PART 8: DATA SECURITY AND STORAGE

Indicate the procedures you plan to implement to safeguard and store the data. Identify the person who will be assuming responsibility for data storage (University regulations require the researcher or the supervisor, in the case of student research, to securely store the data at the University of Saskatchewan for a minimum of five years upon the completion of the study - (Procedures for Stewardship of Research Records at the University of Saskatchewan 2010.)

8.1	**Who will conduct the data collection? GN 8.1** Jennifer O'Brien, study sub-investigator.
8.2	**Who will have access to the original data of the study? GN 8.2** Only the researchers, Jennifer O'Brien and Vivian Hajnal, will have access to original data.
8.3	**How will confidentiality of original data be maintained as well as preserving or destroying data after the research is completed. For all data (e.g. paper records, audio or visual recordings, electronic recordings), indicate the: GN 8.3**
	8.3.1 Person responsible for data storage: Vivian Hajnal
	8.3.2 Data security during transportation from collection site: The deidentified interview recordings will labeled with a unique identifier. The audio file and interview notes will be linked to the participant names by way of a physicaly separate Master Data list. (See Attached - Master list).
	8.3.3 Means and location of storage (e.g. a locked filing cabinet, password protected computer files, encryption): The de-identified audio data from the interviews will be stored on a password protected computer for the duration of the study period. Upon completion of the study, Dr Hajnal will be responsible to store Consent Forms, electronic data files, interview notes, and Master List in a locked filing cabinet in the Department of Educational Administration (which is always locked when empty), as per the University of Saskatchewan Research Integrity Policy (http://www.usask.ca/university_secretary/policies/research/8_25.php).
	8.3.4 Time duration of storage (Must be > 5 Years): 5 years 1 day
	8.3.5 Final disposition (archive, shredding, electronic file deletion): The hard copies of the interview notes and completed consent forms will be destroyed through the confidential paper disposal services of the University of Saskatchewan, while the electronic data will be permanently deleted after 5 years and per the above University of Saskatchewan Research Integrity Policy.
8.4	**Indicate how the data collected is intended to be used (thesis, journal articles, conference presentation, media, etc). GN 8.4** We anticipate this data to be the basis for a publication in a peer-reviewed journal and presentation at academic conferences. At the very least, data will be used in manuscript form to meet the requirements of Jennifer O'Brien's doctoral dissertation.

PART 9: Declaration by Principal Investigator *(or Supervisor for student projects)*

Project Title
Resident research training in anesthesiology: Enhancing the research climate through action research

- I confirm that the information provided in this application is complete and correct.
- I accept responsibility for the ethical conduct of this project and for the protection of the rights and welfare of the human participants who are directly or indirectly involved in this project.
- I will comply with all policies and guidelines of the University and Health Region/affiliated institutions where this project will be conducted, as well as with all applicable federal and provincial laws regarding the protection of human participants in research.
- I will ensure that project personnel are qualified, appropriately trained and will adhere to the provisions of the REB-approved application.
- I certify that any significant changes to the project, including the proposed method, consent process or recruitment procedures, will be reported to the Research Ethics Board for consideration in advance of its implementation.
- I certify that a status report will be submitted to the Research Ethics Board for consideration within one month of the current expiry date each year the project remains open, and upon project completion.
- If personal health information is requested, I assure that it is the minimum necessary to meet the research objective and will not be reused or disclosed to any parties other than those described in the REB-approved application, except as required by law.
- I confirm that adequate resources to protect participants (i.e., personnel, funding, time, equipment and space) are in place.
- I understand that if the contract or grant related to this research project is being reviewed by the University or Health Region, a copy of the ethics application inclusive of the consent document(s), may be forwarded to the person responsible for the review of the contract or grant.
- I understand that if the project involves Health Region resources or facilities, a copy of the ethics application may be forwarded to the Health Region research coordinator to facilitate operational approval.

Signature of Principal Investigator and/or Supervisor	Printed Name of Principal Investigator and/or Supervisor	Date (MM/DD/YY)
Signature of Student Investigator	Printed Name of Student Investigator	Date (MM/DD/YY)

Department Head (UofS and RQHR only) : The signature/approval of the Department/Administrative Unit acknowledges that he/she is aware of and supports the research activity described in the proposal.

Signature of Department Head	Printed Name of Department Head	Date (MM/DD/YY)

Document	Included?	Description
Recruit Material(s)	☐ Yes ☒ N/A	
Letter (s) of Initial Contact	☐ Yes ☒ N/A	
Consent Form(s)	☒ Yes ☐ N/A	
Assent Form(s)	☐ Yes ☒ N/A	
Research Tool(s) (e.g. Questionnaires, focus group guides, interview scripts, etc.)	☒ Yes ☐ N/A	
Transcript Release Form(s)	☐ Yes ☒ N/A	
RQHR Operational/Departmental Approval Form	☐ Yes ☒ N/A	
Other (please specify): Master List	☒ Yes ☐ N/A	

[Your department letterhead]

Participant Consent Form

Project Title: **Resident research in anesthesiology: Enhancing research training through action research**

Researcher(s):
Jennifer O'Brien, PhD candidate
Department of Educational Administration,
University of Saskatchewan,
(306) 655-6497, Jennifer.OBrien@usask.ca

Supervisor:
Vivian Hajnal, Associate Professor
Department of Educational Administration,
University of Saskatchewan,
(306) 966-5675, Vivian.Hajnal@usask.ca

Purpose(s) and Objective(s) of the Research:

- The purpose of this action research study will be to understand the research training climate in Anesthesiology at the University of Saskatchewan, and to collaboratively determine strategies for addressing persistent challenges to resident research training.
- The objectives of this study are to 1) identify shortcomings in the research training climate, 2) explore resident and faculty perceptions of the reasons for these shortcomings, and 3) explore the impact of collaboratively-determined solutions.

Procedures:

- This study has three phases. The first phase will evaluate the research program in Anesthesiology by inviting all 35 residents to complete the Revised Research Training Environment Scale (R-RTES) during a curriculum seminar on statistics, December 13, 2013. Analysis of the R-RTES results will be done together as a teaching exercise in this two-hour seminar.
- In the second phase, at least two residents from each postgraduate year of training (2x5=10 residents) and four faculty research mentors in anesthesiology will be invited to participate in semi-structured interviews and focus groups to explore the underlying reasons for shortcomings, and to generate ideas for improving the research training program. An advisory committee of approximately 6 members will review findings from the interviews and focus groups, and will collaboratively decide upon actions for improvement.
- The third phase will follow the implementation of three action research cycles. At least two residents from each postgraduate year of training (2x5=10 residents) and four faculty research mentors in anesthesiology will be invited to participate in semi-structured interviews and focus groups to reflect on and evaluate the impact of these interventions following their implementation.
- All semi-structured interviews and focus groups will be held in the Department of Anesthesiology or at the Starbucks in the Royal University Hospital, will be audiotaped for research purposes, and are expected to last between 30 minutes and one hour.
- Please feel free to ask any questions regarding the procedures and goals of the study or your role.

Potential Risks:

- Because of the pre-existing relationship that exists between the researcher and the participants, there exists the potential for coercing participation from residents, and the potential loss of confidentiality due to the nature of the researcher's administrative role in the Anesthesiology Resident Research Program. Non-participation or withdrawal of participation will in no way affect how you will be treated or your academic standing.

- The risk of coercion will be addressed by describing the study to you in a group setting and inviting you to approach the researcher individually if you would like to participate. In addition, any evaluations or assessments of anesthesiology residents for the duration of the research will be made in conjunction with a second evaluator.
- The risk for potential loss of confidentiality will be addressed by de-identifying interview notes. Any quotations will be attributed to a pseudonym.
- Participation in this study is voluntary. If you decide to participate in this study, you should only answer questions with which you are comfortable.

Potential Benefits:

- By participating in this research, you will have an opportunity to directly influence the resident research program in Anesthesiology by identifying its shortcomings, proposing solutions, and advising on the choice of interventions to improve the research training environment. I expect that working collaboratively with residents and faculty to improve the research training environment in Anesthesiology will result in improved attitudes toward research and an improved educational climate, but this is not guaranteed.
- This study may serve as an example of action research to be used by other residency programs to improve local research training programs.

Confidentiality:

- The researcher will undertake to safeguard the confidentiality of the discussion, but cannot guarantee that other members of the group will do so. Please respect the confidentiality of the other members of the group by not disclosing the contents of this discussion outside the group, and be aware that others may not respect your confidentiality. Because the participants for this research project have been selected from a small group of people, all of whom are known to each other, it is possible that you may be identifiable to other people on the basis of what you have said.
- You may request that the recording device be turned off any time. After your interview, and prior to the data being included in the final report, you will be given the opportunity to review the interview notes, and to add, alter, or delete information from the notes as you see fit.
- The results from this research project will be used for the researcher's dissertation and published and presented at conferences. The data will be reported in aggregate form and direct quotations may be used, so that it may be possible for others to identify you because of the small sample size.
- The Consent Forms will be stored separately from the audio files and interview notes, so that it will not be possible to associate your name with your responses. Please do not say your name or other identifying information in the interview recording.
- The de-identified audio data from your interview will be stored on a password protected computer for the duration of the study period. Upon completion of the study, Dr. Hajnal will be responsible to store electronic files and master list separately in locked filing cabinets in the Department of Educational Administration. After 5 years, the electronic data will be permanently destroyed and the master list and consent forms will be shredded.

I grant permission to be audio taped:

Yes: ___ No: ___

Right to Withdraw:

- Your participation is voluntary and you decline to answer any questions that make you uncomfortable. You may withdraw from the research project for any reason, up to one month after the interview, without explanation or penalty of any sort. If you participated in an individual interview, your interview recording can be destroyed if you request it. If you participated in a

group interview or focus group, your interview recording will be retained. After this time, it may no longer be possible to withdraw your responses from the analysis.
- Whether you choose to participate or not will have no effect on your residency, your research requirement, or how you will be treated.

Follow up:
If you would like to be part of the advisory group which will determine the priorities for improving the resident research program, speak with the researcher. The results of this study will be available in October 2014 from Jennifer O'Brien, and a summary of results will be posted on the Department of Anesthesiology's publicly available website: http://www.medicine.usask.ca/anesthesiology/

Questions or Concerns:
- Contact the researcher(s) using the information at the top of page 1;
- This research project has been approved on ethical grounds by the University of Saskatchewan Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office ethics.office@usask.ca (306) 966-2975. Out of town participants may call toll free (888) 966-2975.

Consent

Continued or On-going Consent:
- If you choose to participate in a follow-up interview or focus group, your on-going consent will be confirmed verbally.

SIGNED CONSENT
Your signature below indicates that you have read and understand the description provided; I have had an opportunity to ask questions and my/our questions have been answered. I consent to participate in the research project. A copy of this Consent Form has been given to me for my records.

_____	_____	_____
Name of Participant	*Signature*	*Date*

_____	_____
Researcher's Signature	*Date*

A copy of this consent will be left with you, and a copy will be taken by the researcher.

Master List

Resident research training in anesthesiology: Enhancing the research climate through action research		
Study Subject #	**Participant Name**	**email**
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Appendix D - R-RTES Mean Scores, Organized by Subscale

Subscale/Question	*M*	*SD*	*Disagree*	*Somewhat Disagree*	*Neutral*	*Somewhat Agree*	*Agree*
1) Faculty Modeling (α = .80)	**21.83**	**3.59**					
3. (R) Many of our faculty do not seem to be very interested in doing research.	2.48	1.01	0 (0%)	6 (20%)	9 (30%)	10 (33%)	5 (17%)
10. Faculty members often invite residents to be responsible collaborators in the faculty members' own research.	3.57	0.97	1 (0.3%)	3 (10%)	8 (27%)	14 (47%)	4 (13%)
18. The faculty members of my residency program enjoy discussing ideas.	4.07	0.64	0 (0%)	1 (0.3%)	2 (7%)	21 (70%)	6 (20%)
22. The faculty in my residency program is involved in the conduct and publication of high quality research (or theory).	3.67	0.84	1 (0.3%)	0 (0%)	11 (37%)	14 (47%)	4 (13%)
52. The faculty members here are quite open in sharing their research with their residents.	4.20	0.66	0 (0%)	0 (0%)	4 (13%)	16 (53%)	10 (33%)
53. The faculty members of my residency program show excitement about research and scholarly activities.	3.80	0.85	1 (0.3%)	1 (0.3%)	5 (17%)	19 (63%)	4 (13%)
2) Positive Reinforcement (α = 0.43)	**23.00**	**2.52**					
2. (R) My residency program rarely acknowledges the scholarly achievements of students.	4.03	1.25	13	12	1	1	3
4. The faculty does what it can to make research requirements as rewarding as possible.	3.77	0.63	0	0	10	17	3
5. (R) The faculty here only seem to notice a few selected residents in terms of reinforcing scholarly achievements.	3.83	0.95	7	14	7	1	1

6. My residency program provides concrete support for resident research (e.g., access to computers, travel money for making presentations, research supplies, or free postage for mailing surveys).	4.47	0.73	0	1	1	11	17
30. My advisor offers much encouragement to me for my research activities and accomplishments.	4.20	0.76	0	0	6	12	12
44. (R) Most faculty do not seem to really care if residents are genuinely interested in research.	3.37	1.00	4	9	12	4	1
3) Early Involvement in Research (α = 0.59)	**23.73**	**2.91**					
11. I was encouraged to get involved in some aspects of research early in my residency.	4.67	0.61	0	0	2	6	22
19. (R) Much of the research we become involved in is organized in a way that is highly anxiety provoking to residents.	3.37	1.07	4	11	8	6	1
35. (R) It is unusual for first-year students in this program to collaborate with advanced residents or faculty on research projects.	3.37	1.10	4	12	6	7	1
46. During their first year in the program, residents take a research course aimed at developing research skills, interests, and confidence.	4.33	0.84	1	0	1	14	14
50. Residents here seem to get involved in thinking about research from the moment they enter the program.	4.00	0.59	0	0	5	20	5
54. Much of the research we become involved in is intellectually challenging and stimulating.	4.00	0.74	0	1	5	17	7
4) Teaching Relevant Statistics (α = 0.74)	**20.93**	**3.67**					
20. Residents in my program receive sound training in how to design and logically analyze research studies.	3.73	0.83	0	3	6	17	4
23. (R) Statistics courses here are taught in a way that is insensitive to residents' level of development as researchers.	3.53	1.11	5	13	7	3	2

25. The statistics courses we take do a good job, in general, of showing residents how statistics are actually used in anesthesia research.	2.97	1.19	3	10	4	11	2
32. In my research training, the focus has been on understanding the logic of research design and not just statistics.	3.80	0.71	0	0	11	14	5
39. We get high quality training here in the use of statistics in applied research, e.g., clinical research.	3.13	0.82	0	7	13	9	1
42. Our statistics instructors are generally sensitive to students' anxieties and feelings about statistics.	3.77	0.82	0	1	11	12	6
5) Looking Inward for Ideas (α = 0.80)	**23.30**	**3.26**					
14. I have felt encouraged during my training to find and follow my own scholarly interests.	4.07	0.69	0	0	6	16	8
16. The research climate here is one in which residents can get in touch with their own curiosity and with the research questions they themselves want to ask.	3.93	0.74	0	2	3	20	5
29. The faculty members of my residency program encourage me to pursue the research question in which I am interested.	4.07	0.69	0	1	3	19	7
33. Some of the faculty teach residents that during a phase of the research process, it is important for the researchers to "look inward" for interesting research ideas.	3.47	0.63	0	1	15	13	1
47. (R) I feel that I need to choose a research topic of interest to my advisor at the expense of my own interests.	3.63	1.10	7	11	7	4	1
49. (R) Residents in our program feel that their personal research ideas are squashed during the process of collaborating with faculty members, so that the finished project no longer resembles the resident's original idea.	4.13	0.68	9	16	5	0	0
6) Science as a Social Experience (α = 0.69)	**23.50**	**3.19**					

1. In general, my relationship with my advisor is both intellectually stimulating and interpersonally rewarding. (If your advisor has been newly assigned or chosen, respond in terms of what you expect the relationship to be.)	4.40	0.72	0	0	4	10	16
8. There is informal sharing of research ideas and feelings about research ideas in my program.	3.93	0.74	0	1	6	17	6
13. In my residency program there are opportunities to be part of research teams.	3.70	1.06	2	1	7	14	6
26. There is a sense around here that being on a research team can be fun, as well as intellectually stimulating.	3.47	1.01	2	2	9	14	3
34. (R) Generally, residents in my training program do not seem to have intellectually stimulating and interpersonally rewarding relationships with their research advisors.	3.97	0.85	9	12	8	1	0
41. This training environment promotes the idea that although parts of research must be done alone, other parts may involve working closely with other colleagues.	4.03	0.61	0	1	2	22	5
7) All Experiments are Flawed (α = 0.40)	**23.90**	**2.34**					
7. (R) I feel that my advisor expects too much from my research projects.	4.07	1.05	13	9	6	1	1
9. My advisor understands and accepts that any piece of research will have its methodological problems.	4.03	0.67	0	0	6	17	7
21. (R) I have gotten the impression in my residency training that my research work has to be of great value in the field to be worth anything.	3.57	0.86	2	17	8	2	1
27. Residents here are encouraged to at least begin thinking about one or more topics upon which they would like to conduct programmatic research (i.e., a series of studies in which one builds upon another).	4.23	0.73	0	0	5	13	12

37. (R) I have the feeling, based on my training, that my research needs to be completely original and revolutionary for it to be acceptable to the faculty.	3.77	0.73	4	16	9	1	0
40. I get the impression from my training that, although a single study does not revolutionize thinking in the scientific community, such a study can contribute a useful piece to an unfolding body of knowledge.	4.23	0.57	0	0	2	19	9
8) Focus on Varied Investigative Styles (α = 0.69)	**21.67**	**3.29**					
12. Because of the diversity of research approaches among faculty members in my program, I would be able to find help learning about virtually any major research approach, e.g., field, laboratory, experiential, qualitative.	3.13	0.97	1	7	11	9	2
17. Many different research styles (e.g., field vs. laboratory) are acceptable in my residency program.	4.13	0.63	0	0	4	18	8
24. (R) We do not receive sound training in my program on applied, practical, and less traditional approaches to research.	3.83	0.87	7	13	8	2	0
31. (R) Faculty members in my program use an extremely narrow range of research methodologies.	3.63	0.85	6	8	15	1	0
36. (R) There seems to be a general attitude here that there is one best way to do research.	4.10	0.88	12	10	7	1	0
45. During our coursework, residents are taught a wide range of research methodologies, e.g., field, laboratory, survey approaches.	2.83	1.02	3	8	11	7	1
9) Wedding Science and Practice (α = 0.82)	**24.17**	**3.34**					
15. (R) My training program faculty tends to produce research that is not clinically relevant.	3.70	0.75	3	17	8	2	0
28. My residency program has enabled me to see the relevance of research to clinical service.	4.00	0.83	1	0	4	18	7

38. (R) The faculty does not seem to value clinical experience as a source of ideas for research.	4.33	0.66	13	14	3	0	0
43. Our faculty seems interested in understanding and teaching how research can be related to anesthesia practice.	3.87	0.82	0	2	6	16	6
48. There is a prevalent viewpoint in my training program that research findings can be used to improve clinical practice.	4.20	0.66	0	0	4	16	10
51. (R) Residents in this program are rarely taught to use research findings to inform their work with patients.	4.07	0.87	11	11	7	1	0

Appendix E - Comparison of Responses Between Junior and Senior Residents*

Subscale/Question	***Junior Residents n = 16***	***Senior Residents n = 8***	***p***
1) Faculty Modeling	**20.38 (3.86)**	**23.50 (2.27)**	**0.047****
3. (R) Many of our faculty do not seem to be very interested in doing research.	2.31 (1.14)	2.63 (0.74)	0.491
10. Faculty members often invite residents to be responsible collaborators in the faculty members' own research.	3.13 (1.03)	4.00 (0.54)	0.012**
18. The faculty members of my residency program enjoy discussing ideas.	3.81 (0.66)	4.38 (0.52)	0.046**
22. The faculty in my residency program is involved in the conduct and publication of high quality research (or theory).	3.56 (0.89)	4.00 (0.76)	0.248
52. The faculty members here are quite open in sharing their research with their residents.	4.00 (0.73)	4.50 (0.54)	0.101
53. The faculty members of my residency program show excitement about research and scholarly activities.	3.56 (1.03)	4.00 (0.54)	0.185
2) Positive Reinforcement	**22.88 (2.55)**	**23.25 (1.83)**	**0.716**
2. (R) My residency program rarely acknowledges the scholarly achievements of students.	4.06 (1.12)	3.38 (1.60)	0.233
4. The faculty does what it can to make research requirements as rewarding as possible.	3.75 (0.58)	3.63 (0.52)	0.611
5. (R) The faculty here only seem to notice a few selected residents in terms of reinforcing scholarly achievements.	3.69 (1.08)	3.75 (0.71)	0.884
6. My residency program provides concrete support for resident research (e.g., access to computers, travel money for making presentations, research supplies, or free postage for mailing surveys).	4.38 (0.89)	4.50 (0.54)	0.718
30. My advisor offers much encouragement to me for my research activities and accomplishments.	4.06 (0.77)	4.50 (0.76)	0.201
44. (R) Most faculty do not seem to really care if residents are genuinely interested in	2.94 (1.0)	3.50 (0.76)	0.175

research.			
3) Early Involvement in Research	**22.94 (3.38)**	**24.25 (1.49)**	**0.309**
11. I was encouraged to get involved in some aspects of research early in my residency.	4.63 (0.72)	4.63 (0.52)	1.000
19. (R) Much of the research we become involved in is organized in a way that is highly anxiety provoking to residents.	3.13 (1.03)	3.50 (1.07)	0.414
35. (R) It is unusual for first-year students in this program to collaborate with advanced residents or faculty on research projects.	3.13 (1.09)	3.13 (1.13)	1.000
46. During their first year in the program, residents take a research course aimed at developing research skills, interests, and confidence.	4.19 (1.05)	4.63 (0.52)	0.280
50. Residents here seem to get involved in thinking about research from the moment they enter the program.	3.94 (0.57)	4.13 (0.64)	0.475
54. Much of the research we become involved in is intellectually challenging and stimulating.	3.94 (0.77)	4.25 (0.46)	0.306
4) Teaching Relevant Statistics	**21.50 (3.92)**	**19.63 (2.13)**	**0.223**
20. Residents in my program receive sound training in how to design and logically analyze research studies.	3.69 (.87)	3.88 (0.64)	0.597
23. (R) Statistics courses here are taught in a way that is insensitive to residents' level of development as researchers.	3.44 (1.15)	3.13 (0.99)	0.520
25. The statistics courses we take do a good job, in general, of showing residents how statistics are actually used in anesthesia research.	3.31 (1.25)	2.50 (0.54)	0.037**
32. In my research training, the focus has been on understanding the logic of research design and not just statistics.	3.75 (0.78)	3.88 (0.64)	0.698
39. We get high quality training here in the use of statistics in applied research, e.g., clinical research.	3.31 (0.79)	3.00 (0.54)	0.268

42. Our statistics instructors are generally sensitive to students' anxieties and feelings about statistics.	4.00 (0.816)	3.25 (0.707)	0.038**
5) Looking Inward for Ideas	**22.25 (3.30)**	**24.13 (2.30)**	**0.165**
14. I have felt encouraged during my training to find and follow my own scholarly interests.	4.00 (0.73)	4.13 (0.64)	0.685
16. The research climate here is one in which residents can get in touch with their own curiosity and with the research questions they themselves want to ask.	3.88 (0.81)	4.00 (0.54)	0.697
29. The faculty members of my residency program encourage me to pursue the research question in which I am interested.	3.88 (0.81)	4.25 (0.46)	0.239
33. Some of the faculty teach residents that during a phase of the research process, it is important for the researchers to "look inward" for interesting research ideas.	3.31 (0.48)	3.38 (0.74)	0.805
47. (R) I feel that I need to choose a research topic of interest to my advisor at the expense of my own interests.	3.19 (1.17)	4.13 (0.64)	0.019**
49. (R) Residents in our program feel that their personal research ideas are squashed during the process of collaborating with faculty members, so that the finished project no longer resembles the resident’s original idea.	4.00 (0.63)	4.25 (0.71)	0.389
6) Science as a Social Experience	**22.25 (3.13)**	**25.00 (2.14)**	**0.037****
1. In general, my relationship with my advisor is both intellectually stimulating and interpersonally rewarding. (If your advisor has been newly assigned or chosen, respond in terms of what you expect the relationship to be.)	4.38 (0.62)	4.63 (0.74)	0.392
8. There is informal sharing of research ideas and feelings about research ideas in my program.	3.75 (0.78)	4.13 (0.64)	0.251
13. In my residency program there are opportunities to be part of research teams.	3.31 (1.20)	4.00 (0.76)	0.154
26. There is a sense around here that being on a research team can be fun, as well as intellectually stimulating.	3.13 (1.15)	3.88 (0.64)	0.102

34. (R) Generally, residents in my training program do not seem to have intellectually stimulating and interpersonally rewarding relationships with their research advisors.	3.88 (0.72)	4.00 (0.93)	0.718
41. This training environment promotes the idea that although parts of research must be done alone, other parts may involve working closely with other colleagues.	3.81 (0.66)	4.38 (0.52)	0.046**
7) All Experiments are Flawed	**23.38 (1.96)**	**25.13 (2.17)**	**0.059**
7. (R) I feel that my advisor expects too much from my research projects.	3.88 (1.26)	4.38 (0.74)	0.314
9. My advisor understands and accepts that any piece of research will have its methodological problems.	3.81 (0.65)	4.38 (0.52)	0.046**
21. (R) I have gotten the impression in my residency training that my research work has to be of great value in the field to be worth anything.	3.75 (0.68)	3.63 (0.74)	0.685
27. Residents here are encouraged to at least begin thinking about one or more topics upon which they would like to conduct programmatic research (i.e., a series of studies in which one builds upon another).	4.19 (0.75)	4.38 (0.74)	0.569
37. (R) I have the feeling, based on my training that my research needs to be completely original and revolutionary for it to be acceptable to the faculty.	3.63 (0.72)	3.88 (0.64)	0.415
40. I get the impression from my training that, although a single study does not revolutionize thinking in the scientific community, such a study can contribute a useful piece to an unfolding body of knowledge.	4.13 (0.62)	4.50 (0.54)	0.159
8) Focus on Varied Investigative Styles	**20.69 (3.07)**	**23.13 (2.42)**	**0.063**
12. Because of the diversity of research approaches among faculty members in my program, I would be able to find help learning about virtually any major research approach, e.g., field, laboratory, experiential, qualitative.	2.69 (0.87)	3.75 (0.71)	0.007**

17. Many different research styles (e.g., field vs. laboratory) are acceptable in my residency program.	4.06 (0.68)	4.25 (0.71)	0.536
24. (R) We do not receive sound training in my program on applied, practical, and less traditional approaches to research.	3.81 (0.83)	3.75 (0.71)	0.858
31. (R) Faculty members in my program use an extremely narrow range of research methodologies.	3.38 (0.81)	3.88 (0.84)	0.171
36. (R) There seems to be a general attitude here that there is one best way to do research.	3.94 (0.93)	4.38 (0.74)	0.260
45. During our coursework, residents are taught a wide range of research methodologies, e.g., field, laboratory, survey approaches.	2.81 (0.98)	3.13 (0.64)	0.425
9) Wedding Science and Practice	**23.81 (3.71)**	**25.13 (3.04)**	**0.397**
15. (R) My training program faculty tends to produce research that is not clinically relevant.	3.63 (0.62)	4.00 (0.76)	0.207
28. My residency program has enabled me to see the relevance of research to clinical service.	3.94 (1.00)	4.13 (0.64)	0.635
38. (R) The faculty does not seem to value clinical experience as a source of ideas for research.	4.25 (0.68)	4.50 (0.54)	0.376
43. Our faculty seems interested in understanding and teaching how research can be related to anesthesia practice.	3.81 (0.91)	3.88 (0.84)	0.872
48. There is a prevalent viewpoint in my training program that research findings can be used to improve clinical practice.	4.19 (0.66)	4.50 (0.54)	0.256
51. (R) Residents in this program are rarely taught to use research findings to inform their work with patients.	4.00 (0.97)	4.13 (0.84)	0.758

*Values are reported as *M* (*SD*) unless otherwise specified. **Significance is flagged when $p<$ 0.05.

Appendix F - Comparison of Responses on Subscale 4, 'Teaching Relevant Statistics'

Between Attendees and Non-Attendees of Curriculum Seminar on Statistics*

Questions from Subscale 4, 'Teaching Relevant Statistics'	***Attended stats seminar***	***Did not attend stats seminar***	***p***
20. Residents in my program receive sound training in how to design and logically analyze research studies.	3.75 (0.85)	3.70 (0.82)	0.879
23. (Rev) Statistics courses here are taught in a way that is insensitive to residents' level of development as researchers.	3.85 (0.99)	2.90 (1.10)	0.024**
25. The statistics courses we take do a good job, in general, of showing residents how statistics are actually used in anesthesia research.	3.25 (1.25)	2.40 (0.84)	0.037**
32. In my research training, the focus has been on understanding the logic of research design and not just statistics.	3.85 (0.75)	3.70 (0.68)	0.597
39. We get high quality training here in the use of statistics in applied research, e.g., clinical research.	3.20 (0.89)	3.00 (0.67)	0.538
42. Our statistics instructors are generally sensitive to students' anxieties and feelings about statistics.	4.05 (0.76)	3.20 (0.63)	0.005**

*Values are reported as *M* (*SD*) unless otherwise specified. **Significance is flagged when $p <$ 0.05.

Appendix G - Comparison of Responses on Subscale 6, 'Science as a Social Experience'

Between R1s and All Other Residents*

Questions from Subscale 6, 'Science as a Social Experience'	***R1s***	***Other Residents***	***p***
1. In general, my relationship with my advisor is both intellectually stimulating and interpersonally rewarding. (If your advisor has been newly assigned or chosen, respond in terms of what you expect the relationship to be.)	4.40 (0.55)	4.47 (0.70)	0.829
8. There is informal sharing of research ideas and feelings about research ideas in my program.	4.20 (0.45)	3.79 (0.79)	0.280
13. In my residency program there are opportunities to be part of research teams.	2.60 (1.14)	3.79 (0.98)	0.028**
26. There is a sense around here that being on a research team can be fun, as well as intellectually stimulating.	2.40 (0.89)	3.63 (0.96)	0.017**
34. (R) Generally, residents in my training program do not seem to have intellectually stimulating and interpersonally rewarding relationships with their research advisors.	3.80 (0.84)	3.95 (0.78)	0.714
41. This training environment promotes the idea that although parts of research must be done alone, other parts may involve working closely with other colleagues.	4.00 (0.71)	4.00 (0.67)	1.00

*Values are reported as *M* (*SD*) unless otherwise specified. **Significance is flagged when $p<$ 0.05.